SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE, PUBLISHED MONTHLY

VOLUME XIII OCTOBER, 1911 NUMBER 4

THE USE OF SILVER WIRE IN OPENING THE KIDNEY[1]

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IN our preliminary report[2] reference was made to the various types of incisions employed in experiments upon dogs. It is the intention in this paper to give in some detail the findings obtained in our first series of experiments, together with those which have been performed since the publication of our first paper. The silver wire method has been applied in quite a number of cases of nephrotomy in the human subject. These cases together with the various incisions employed will be discussed subsequently.

The reasons assigned for using the wire instead of the knife were given in the original paper, but we shall here briefly reiterate them.

"The researches of Brödel[3] on the anatomical structure and vascularization of the kidney are so well known that little comment is necessary. With his celloidin corrosion specimens he has beautifully demonstrated the arborescent branching of the renal arteries and a most casual inspection of these preparations cannot fail to impress one that any method of nephrotomy that would aim to minimize hæmorrhage must pay due regard to the character of this branching.

"In man and the dog there are, as a rule, two main arterial trunks supplying the kidney, one passing to the anterior, the other to the posterior portion. While studying the tree-like branching of these arterial trunks, the thought occurred: could it be possible to open the kidney in such a manner as to avoid the two main trunks, and, at the same time, do as little damage as possible to the finer branches?

"If it were necessary to pass a wire between two trees, the branches of which interlaced, it is obvious that this could be more readily accomplished and with less damage to the trees, by passing the wire from below upward than from above downward. In its upward passage the branches would slip aside and the twigs and leaves would be the only structures damaged, whereas in the downward movement of the wire, the less resistant branches would be broken or considerably bruised. Similarly, were a sharper instrument than the wire used, the same comparative results would be obtained. While all the branches would be severed in its downward direction, a considerable number would undoubtedly escape when the instrument was directed upward.

"With these simple facts in mind, it occurred to us that anatomically, the proper procedure in performing a nephrotomy would

[2] The Use of Silver Wire in Opening the Kidney. The Johns Hopkins Hospital Bulletin, 1909, xx, 350.

[3] Brödel. The Johns Hopkins Hospital Bulletin, 1901, xii.

[1] From the Hunterian Laboratory of the Johns Hopkins University.

be to cut from within outward, and that some blunt[1] instrument which would push the vessels aside would probably give the most satisfactory results." [2]

In order to determine the feasibility of this supposition, a series of nephrotomies was performed on dogs. A No. 3 silver wire was used as the blunt instrument and proved satisfactory, its pliability and low tensile strength allowing it to slip to one side of the larger branches, providing ordinary care was exercised in drawing the wire slowly outward with a sawing motion. Two series of experiments were performed to determine, first whether the direction of the incision had any appreciable effect on the resulting hæmorrhage, that is, whether the hæmorrhage would be less if the knife were passed from the region of the kidney pelvis through the cortex and capsule, than from the capsule into the pelvis; secondly, whether the hæmorrhage would be lessened and more readily controlled if a silver wire were used in lieu of the knife in opening the kidney from within outward.

In the first series of experiments, where the knife alone was used, all the incisions were made in a plane at right angles to the curved lateral border of the kidney. Two incisions were employed in each experiment, one by passing the knife from cortex to pelvis and the other by transfixing the kidney in the antero-posterior manner, close to the pelvis and bringing the knife out through the cortex. Each of these incisions was made at a distance approximately 2 cm. from either pole.

In these two incisions the hæmorrhage was a little less marked when the knife was directed from pelvis to cortex, but the difference in amount was not at all striking. Accurate measurements of the amount of hæmorrhage were not made in this series. The wounds were closed with two rows of catgut sutures, one deep and one superficial.

In the second series both the knife and silver wire were used and the experiments divided into two separate groups:

1. Those in which incisions were made in planes at right angles to the curved lateral border of the kidney. These we have termed *transverse* or *radial* incisions.

2. Those in which the kidney was opened from pole to pole. This type of incision we have called the *coronal* or *longitudinal* section.

In the first group (transverse incision) an incision was made with the knife at a distance of about 2 cm. from the lower pole and at the upper pole the kidney was opened from within out, that is, from pelvis to cortex, with the silver wire. The wire was usually employed first.

GROUP I. TRANSVERSE OR RADIAL INCISION

A No. 3 or 4 silver wire threaded on a Konsnietzoff-Cullen[3] straight liver needle was passed through the kidney at the upper end of the pelvis. The capsule was then nicked with the knife from the point of entrance of the needle, around to the point of exit, in order to avoid tearing the more resistant capsule. With the kidney held firmly in the hands of the assistant the wire was readily brought out to the surface by a gentle see-saw motion. The amount of hæmorrhage in a given time of twenty seconds was then accurately measured. On examination the cut surfaces appeared almost as smooth as if a knife had been used. They showed an occasional small spurting vessel, but in most instances, the bleeding was essentially venous in character and could be readily controlled by mere approximation of the two surfaces. The wound was closed with one superficial row of mattress sutures of fine black silk.

At a corresponding distance from the upper pole a transverse incision was made with the knife, passing from the cortex to the pelvis. The amount of ensuing hæmorrhage was then similarly measured. Examination of the cut surfaces showed free hæmorrhage with some actively spurting arteries, quite a different picture from that obtained with the wire. This wound was also closed with superficial mattress sutures of fine black silk, but more were usually necessary than in the wire incision. Occasionally it was necessary to place a deep mattress suture of catgut.

After replacing the kidney the body wound was closed in layers without drainage.

[1] Brödel, in 1901, suggested the use of a curved knife with a blunt edge. The Johns Hopkins Hospital Bulletin, 1901, xii.

[2] It must, however, be remembered that in opening the kidney from within out, one first encounters the relatively dense medullary substance in the interior, before it reaches the more friable cortex.

[3] Cullen, T. S. Journal Am. Med. Assoc., April, 1905.

Hæmorrhage. The results obtained in this group of experiments were satisfactory, as shown in the accompanying table No. 1. When the knife was employed the cut surfaces showed free hæmorrhage, with some actively spurting arteries. On the other hand, when the wire was used, there was free venous oozing but only occasionally was an actively spurting artery visible. In the first instance, pressure on the renal artery was necessary to allay the hæmorrhage, whereas in the latter there was a spontaneous subsidence of the bleeding. In one case the bleeding ceased entirely at the end of three minutes, although the pulsation of the renal artery was quite distinctly visible.

Comparative study of the quantity of extravasated blood in this group showed an average ratio of 1:2 in favor of the wire. In other words, the amount of bleeding resulting from the use of the wire was one-half of that obtained when the incision was made with the knife. In certain instances the individual ratio was very different. In dog No. 7 (table 1) the ratio was 1 : 9. In cutting with the knife sufficient care had evidently not been taken and the incision was carried too far, cutting one of the large arterial trunks. In one other experiment the result was different. In dog No. 5 (table 1) the bleeding from the knife incision was 12 cc., whereas in the wire incision it was 20 cc. We believe that in this instance the knife by good fortune chanced to pass through an avascular zone.

All of the dogs were not weighed, but the average weight was 6 to 7 kilo, so there is little room for error in the comparative results in bleeding.

In table No. 1 is given the comparative amount of bleeding in 20 seconds, obtained in the transverse incisions of the wire and the knife.

TABLE NO. 1

	Wire Pelvis to Cortex	Knife Cortex to Pelvis
Dog 5	20 cc.	12 cc.
Dog 6	16 cc.	40 cc.
Dog 7	3 cc.	27 cc.
Dog 8	6 cc.	10 cc.
Dog A	8 cc.	13 cc.
Dog B	6 cc.	17 cc.
Dog C	12 cc.	23 cc.
Total	71 cc.	142 cc.
Average	10.1 cc.	20.2 cc.
Ratio	1 :	2

Dogs A, B, and C were operated upon by students under the direction of the authors in the course in operative surgery.

GROUP II. LONGITUDINAL SECTION OF THE KIDNEY

In the second group of this series the kidney was laid open from pole to pole and the pelvis widely opened. The wire incision was employed in five nephrotomies and the knife in a corresponding number.

Wire. A No. 3 silver wire threaded on a curved liver needle was passed through the cortex close to one pole, a little posterior to the median plane, and pushed into the pelvis. Passing along through the pelvis it was pushed outward and emerged at a corresponding point near the opposite pole. The capsule was then nicked with the knife along the line joining these two points. By a gentle see-saw motion the wire was gradually drawn out to the surface and the kidney pelvis laid well open. During this procedure the kidney was held firmly between the thumbs and forefingers of the assistant in order to maintain good countertraction, thus avoiding undue traction on the main renal vessels. In its upward passage the wire usually followed the avascular zone of Brödel[1] and only in a few instances were small actively spurting arteries visible on the cut surface. The amount and character of the bleeding was comparatively the same as that found in the transverse incisions with the wire. The hæmorrhage was readily controlled by light approximation of the two surfaces. The amount of bleeding in 20 seconds was accurately measured.

Knife. In the nephrotomy with the knife the kidney was split open along the same line from pole to pole and the pelvis also widely opened. The amount of extravasation was then measured and the cut surfaces examined. In nearly every instance actively spurting arteries were visible and these could be controlled only by pressure on the main renal vessels. The comparative results of this incision were similar to those of the transverse incisions in which the knife was employed.

The wounds in both of these types were closed with superficial mattress sutures of

[1] The Johns Hopkins Hospital Bulletin, 1901, xii.

fine black silk, one or two more being usually necessary in the knife incision. Occasionally in the latter a deep mattress suture of catgut was employed.

Hæmorrhage. In this group the comparative amount of hæmorrhage is shown in table No. 2. It is interesting to note that the ratio of wire and knife is almost identical with that obtained in the transverse incisions. Another interesting feature is the greater uniformity in the amount of hæmorrhage caused by the knife. The variation in the amount of hæmorrhage in the wire incisions is striking. In dogs Nos. 9 and 11 there was a minimal amount of bleeding, while in Nos. 10 and 18 there was a maximal amount. This variation can be ascribed to the accuracy with which the wire passed through the avascular zone. In nephrotomy in the human subject the surface markings are a most valuable aid in determining the location of the avascular zone. In the dog this zone lies with considerable regularity in the median plane.

Table No. 2 shows the comparative amount of bleeding obtained in twenty seconds in longitudinal section of the kidney. The size of the dog in this series is an important factor, but unfortunately the weight was not obtained in all cases. The average was 6 to 7 kilo.

TABLE NO. 2

LONGITUDINAL SECTION OF THE KIDNEY

Wire Incision		Knife Incision	
Dog No. 9	6 cc.	Dog No. 12	31 cc.
Dog No. 10	24 cc.	Dog No. 14	36 cc.
Dog No. 11	8 cc.	Dog No. 15	30 cc.
Dog No. 13	14 cc.	Dog No. 16	28 cc.
Dog No. 18	28 cc.	Dog No. 17	30 cc.
Total	80 cc.	Total	155 cc.
Average	16 cc.	Average	31 cc.

Ratio, 1 cc. : 1.9 cc.

To recapitulate: In all incisions made with the knife, spurting vessels were found, while in those in which the wire was employed, although an occasional spurter was present, the bleeding was essentially venous in character. So slight was the bleeding in a few instances that it could be almost completely stopped by pressure with gauze wrung out of hot salt solution. Of course in any case of nephrotomy the bleeding can be checked if constant pressure is applied to the renal vessels, either manually or by means of a clamp.[1] In these experiments bleeding was allowed to continue unchecked in order to obtain an index not only of the amount of damage to the renal vessels but also through them to the renal parenchyma. The infarct formation in these two types of incisions will be discussed subsequently.

Postoperative course. The convalescence was usually uneventful. Three animals, not mentioned in either table, died early of some intercurrent affection. In no case did any animal show postoperative hæmorrhage. The postoperative study of the amount of blood present in the urine was not made.

GROSS AND HISTOLOGICAL DESCRIPTIONS OF SPECIMENS

The animals were sacrificed after a month and both kidneys removed for comparative study. They were then placed in ten per cent formalin and when sufficiently hardened gross description was made. Sections were then obtained and prepared for histological examination. The usual celloidin method was employed and the sections stained with hæmatoxylin and eosin.

Gross description. In most instances the operated kidney showed only slight diminution in size. The intact kidney usually showed a slight compensatory hypertrophy. The diminution in size was more marked in the case of nephrotomy with the knife, undoubtedly on account of the infarct scar formation. At the site of the incision there was invariably a depression on the surface and over this the capsule was densely adherent and thickened. On section the kidney showed an infarct, well defined from the normal looking renal tissue.

Infarct formation. The amount of renal parenchyma damaged in any nephrotomy is a most important consideration, and that method in which the least possible destruction results is undoubtedly the one of choice. Bearing in mind the fact that the renal arteries belong to the endartery type and that any

[1] Silk and silkworm gut were tried in a few instances, but these were not so satisfactory as the wire. The former caused tearing of the smaller vessels and the latter readily cut through the finer branches. The smooth surface of the wire, its uniform caliber, and its low tensible strength render it most suitable.

occlusion or destruction of these vessels results in a wedge-shaped infarct of the area supplied by such vessel, it is of the utmost importance to avoid all possible injury both to the arterial trunks and their branches. Tuffier[1] in his experimental studies of nephrotomy wounds comments in some detail upon the infarct formation. His descriptions include the picture observed twenty-four hours, forty-eight hours, five days, and twelve days after operation. The typical wedge shape was present. The description twelve days after operation corresponds in some measure with ours, but the connective tissue reparative changes are much less evident. For a complete description of the immediate changes following nephrotomy with the knife the reader is referred to the original article.

In our experiments we did not study the early changes in the infarct formation. The intention was to study the infarct at a time when reparative changes were fairly well marked, and determine the ultimate change in the kidney when incision was made with the wire or with the knife.

INFARCT PRODUCED BY THE KNIFE

At the site of the incision there was invariably a dipping in of the thickened and densely adherent capsule. In the transverse incisions the infarct was always wedge-shaped but in the longitudinal incision the infarct showed a fairly uniform width throughout its course. Broadest at the base, these infarcts gradually narrowed down to a thin band which ended in the papillary portion at the pelvis. The tissue of the infarct was grayish brown in color and stood out in sharp contrast to the adjacent well injected renal tissue. In the transverse incision the base of the wedge averaged about 5 mm. in width. In the longitudinal section the average was about 4 mm.

Histological examination. Histologically, all the infarcts produced by the knife presented essentially the same picture. Fig. 1 (knife) represents the infarct produced by the transverse incision. The characteristic wedge shape and sharply defined margins are well seen. The infarct extends from cortex to pelvis, gradually narrowing as it reaches this latter point. Under the low power magnification the main portion of the infarcted area shows a diffuse hyaline tissue in which the shadows of the tubules and glomeruli persist in varying degree. The latter are a little more resistant to the degenerative process. Passing down from the capsule into the cortical portion of the infarct are strands of newly formed connective tissue, but these are limited to the peripheral portion. Along the margins of the infarct in the cortical portion, numerous small round cells and some polymorphonuclear leucocytes are present. The glomeruli and tubules of the adjacent renal tissue show only in places slight hyaline change.

INFARCT PRODUCED BY THE WIRE

The infarct resulting from these incisions was in nearly every instance smaller than in those in which the knife was employed. In the transverse incision the wedge shape was present, but the area involved was considerably smaller, averaging about 2 to 3 mm. in width. In the longitudinal incisions the linear type predominated and here also the width of the infarct was diminished, the average being 1 to 2 mm.

The depression on the surface was shallow, the capsule thickened and rich in blood-vessels. The infarct presented a grayish brown color and along the margins the Prussian blue colorization was quite marked. The line of demarkation from the surrounding kidney tissue was not so well defined as that caused by the knife. An interesting feature of these infarcts is a narrow slit, less than 1 mm. in width, passing from the pelvis up into the infarct. The arrow in Fig. 1 (wire; see plate) shows the position and direction of this slit. Further attention will be given to this in the histological description.

Histological examination. The infarct consists of a narrow, fairly well defined band of hyaline tissue. The glomeruli and tubules show marked degenerative changes and in places only shadowy outlines are visible. Dipping in from the capsule are strands of connective tissue carrying newly formed blood-vessels. Along the margins, in the cortical portion, are small round cells in varying

[1] Études experimentales sur la Chirurgie du Rein. Paris 1889.

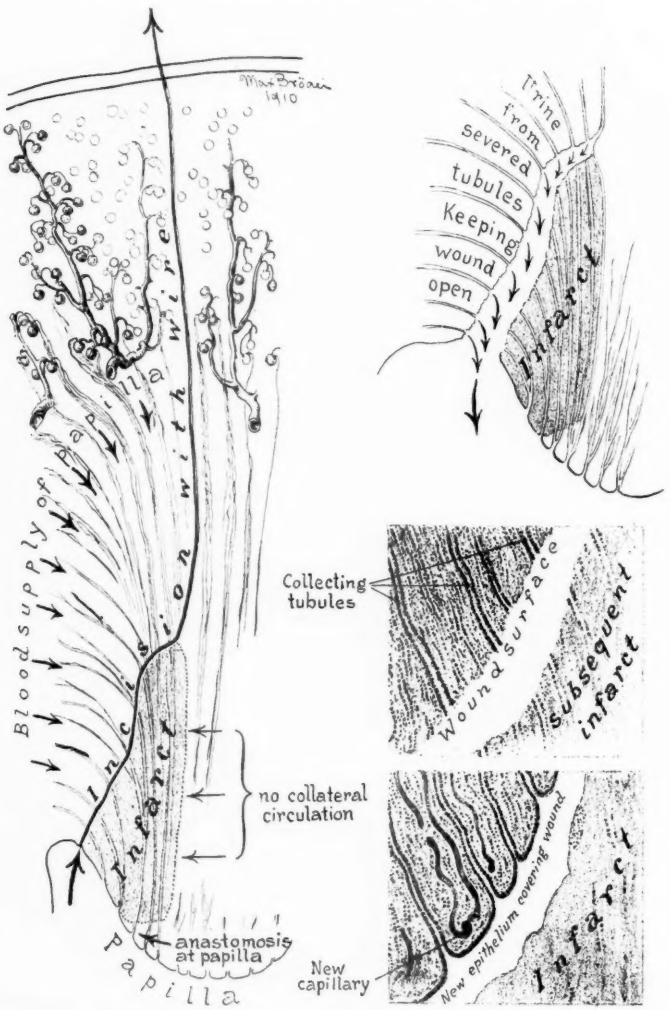

Fig. 2. Diagram illustrating the topography of the wire incision and the healing of the medullary wound. The diagram to the left explains the formation of the papillary infarct. The upper right diagram demonstrates why the papillary wound remains open. In the lower right diagram is shown the appearance of the papillary wound before and after healing.

numbers and some polymorphonuclear leucocytes. Between the cortical and papillary portions, i. e., the boundary zone, the infarct in several specimens narrows down to a thin line, separating the collecting tubules. In the papilla involved there is a fairly broad strip of hyaline tissue sharply defined from the surrounding normal parenchyma. (Fig. 1, wire.) This represents the distal portion of the group of collecting tubules, severed in the upward passage of the wire. The blood supply of these has been completely cut off and no collateral circulation exists. (Fig. 2.) Along the central side of this papillary portion of the infarct is the slit above mentioned. This represents the line of passage of the wire. On account of the flow of urine over this wound surface it has failed to unite. One

month after operation this is found to be covered by newly formed epithelium, evidently derived from the epithelial lining of the collecting tubules. (See Fig. 2.) There is no epithelial lining of the wound along the infarct's margin.

NEPHROTOMY IN THE HUMAN SUBJECT

Having become convinced from our experimental work of the superiority of the wire over the knife, occasion was granted by Dr. Thomas S. Cullen[1] to test the method in opening the human kidney in a case of nephrolithiasis. The result was most satisfactory. Since its employment in this first case, the wire has been used in a number of cases, both in Professor Halsted's and Professor Kelly's clinics in this hospital. The results in these cases are given in table No. 3.

Pyelotomy versus nephrotomy. It is not our intention to discuss the question of nephrotomy versus pyelotomy. In certain instances the one may be preferable to the other. We merely wish to show that when nephrotomy is indicated it is well to employ a dull instrument, such as the wire.

Hæmorrhage. Having found in our experimental work that the wire was preferable to the knife, it is natural to believe that its employment in opening the human kidney would be equally as satisfactory, for the anatomical character of the vascular network is essentially the same in the dog as in man.

Although we have no definite means of determining in human nephrotomy the comparative bleeding, it is our impression that the bleeding has been less when the wire was employed. The loss of blood in some instances even with the wire was severe, as a study of table No. 3 will show. Explanation of this lies in the fact that the line of incision has not always been made in the proper place; that is, it has not followed the avascular zone of Brödel.

TOPOGRAPHY OF THE KIDNEY

Every nephrotomy should be preceded by an examination of the surface of the kidney in order to determine the proper location of the incision. The operator should know that the anterior circulation predominates over the posterior in over four-fifths of the cases. Such kidneys are round in front, with pulsating arteries at the anterior hilum. The posterior surface is flat and shows a deep notch, the posterior hilum, in which the renal pelvis lies. The plane of vascular division in such kidneys is more or less in the posterior parenchyma. The deeper the notch the further posterior is the vascular division. Such data can readily be obtained by palpation if visual inspection prove impossible. The operator should likewise know that in about one-fourth of the cases the plane of arterial division is either in the mid-plane of the kidney or in the anterior parenchyma. If palpation reveals the presence of a deep notch in the anterior hilum, while in the posterior hilum pulsating arteries are felt, the longitudinal incision should be made through the anterior parenchyma. If no notch is felt on either side of the hilum, the incision should be exactly in the central plane of the kidney.

It is also of importance to determine before opening a kidney whether the pelvis is an intrarenal or an extrarenal structure, for while in the former case a single incision would be perfectly safe, in the latter it would be exceedingly hazardous; for an extrarenal pelvis means a divided pelvis with thick parenchyma between, which always contains numerous large arteries and veins. An intrarenal pelvis is easily recognized on the surface by a narrow small hilum with recurving poles, while an extrarenal pelvis is associated with a long wide hilum, with the renal poles far apart. In a divided pelvis two separate incisions, as pictured in Fig. 9, represent the proper mode of procedure.

TECHNIQUE OF INCISIONS IN HUMAN NEPHROTOMY

The human kidney being much larger than the dog's, it is possible and also advisable to utilize the pelvis in introducing the wire. In performing a nephrotomy the amount of renal parenchyma exposed should be the least possible to obtain the desired result. In cases where a small stone is present at the

[1] This nephrotomy was performed at the Church Home and Infirmary February 25, 1909.

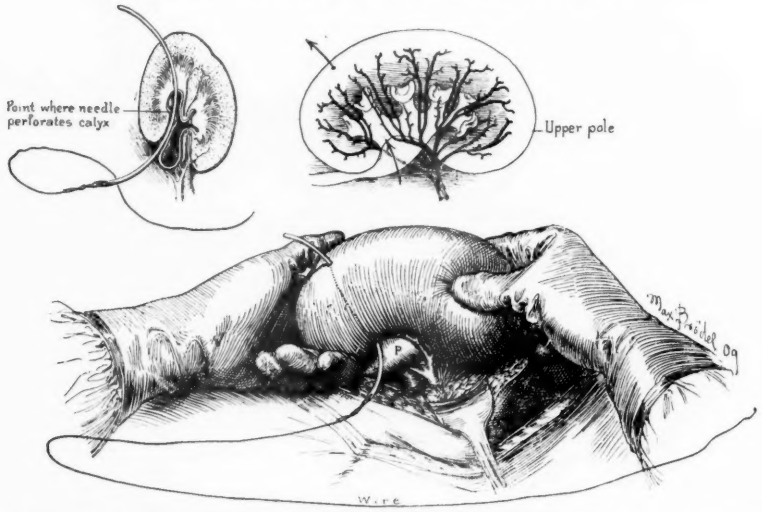

Fig. 3. The placing of the silver wire with the curved needle in an oblique direction through the posterior parenchyma. The needle enters the renal sinus between parenchyma and pelvis at the lower end of the hilum, glides along the lower posterior calyx until the point of the needle encounters the corresponding papilla, at which point the pelvis is perforated (see upper left diagram). The needle is now gently pushed through the renal parenchyma until it is seen to emerge at the lateral border. The upper right diagram illustrates the direction of the blood-vessels in relation to this incision. It is clearly seen that this proposed oblique incision runs through an avascular zone and opens in the lower half of the renal pelvis.

lower pole a radial incision (Fig. 3) can be made with a minimal amount of damage. When wide exposure is necessary, as in the presence of several stones, or one stone at the upper pole, the incision shown in Fig. 5 is employed. When exploratory nephrotomy, for other than stone, is indicated, the incision shown in Figs. 7 and 8 is preferable. In every incision care should be taken to avoid as far as possible both renal poles, as these are rich in venous plexuses and these are esssential for the drainage of the posterior half of the kidney.

Exposure of the kidney. The kidney is delivered through the oblique incision over the superior lumbar triangle (Kelly) and after careful study of its topography incision is made in the line indicated.

RADIAL INCISION FOR REMOVAL OF SMALL STONE AT LOWER POLE

The technique of this incision is so well shown in Figs. 3 and 4 that little explanation is necessary. A curved liver needle, on which is threaded a No. 3 silver wire, is introduced into the pelvis of the kidney at its upper posterior margin (Fig. 4) and passing through the upper portion of the pelvis into one of the calices is emerged at a radial point on the convex border. The capsule is then split with the knife along the line of opening to avoid tearing (see dotted line Fig. 3). By gentle see-saw motion traction is then made on the wire. At first fairly strong traction is necessary to cut through the more resistant connective tissue of the pelvis. As soon as the softer less resistant tissue of medulla and cortex is reached, traction should be so gentle as to avoid tearing of the smaller renal arterial branches.

With such an incision the kidney is readily opened and the stone removed. If more room is necessary this incision can be extended downward through the wall of the pelvis.

L-SHAPED INCISION FOR REMOVAL OF SEVERAL STONES OR A STONE AT THE UPPER POLE

When removal of several stones is necessary, good exposure is essential or much damage will result to the renal parenchyma

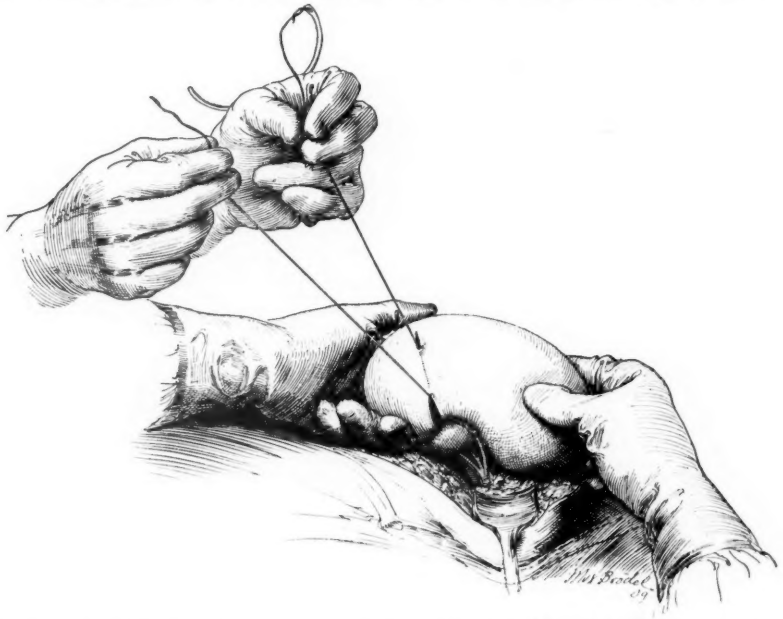

Fig. 4. Second step in this incision. Note how counter-traction is made by the hands grasping the kidney.

from undue manipulation in removing the stones. If a stone is present at the upper pole this incision should also be employed. "Never make a radial wire incision at the *upper* pole as incision at this point will pass through the large posterior branch of the renal artery."

Figs. 5 and 6 illustrate the procedure in this type of incision. The first step consists in making the oblique or radial opening as described in Figs. 3 and 4. At the upper end of this first incision the needle is reintroduced into the pelvis and brought out at a corresponding point near the upper pole. After splitting of the capsule with the knife the kidney is then opened as shown in Fig. 6.

These two incisions permit the turning out of a flap of kidney tissue, affording a thorough exploration and examination of the kidney pelvis, without injury to any arterial branches.

A very large branching stone can best be extracted by simply cutting down upon it with the knife, since in such cases the blood vessels are already widely separated by the pelvic stone and the parenchyma more or less thinned out. Little refinement of technique is necessary in such cases.

Exploratory nephrotomy. In certain obscure renal conditions such as "essential hæmaturia" or in suspected tuberculosis, examination of the kidney parenchyma is often advisable. Wide exposure of the pelvis is not essential, hence the incision shown in Figs. 7 and 8 represents the one of preference rather than the L-shaped incision.

A small vertical slit in the posterior wall of the pelvis is made with the knife and the silver wire with a straight liver needle threaded on either end is introduced as shown in Fig. 7. Each needle is then successively passed through the pelvis in an oblique direction and traversing the kidney substance emerged at the corresponding points on the surface (Fig. 7). The wire is then pulled taut and is in position for use (Fig. 8). The small opening in the pelvis can then be immediately closed with fine catgut. The nephrotomy is then completed in the usual manner.

By such a procedure the needle is always certain to enter the pelvis, even though it be collapsed. A most important feature of such an incision is the avoidance of any injury to

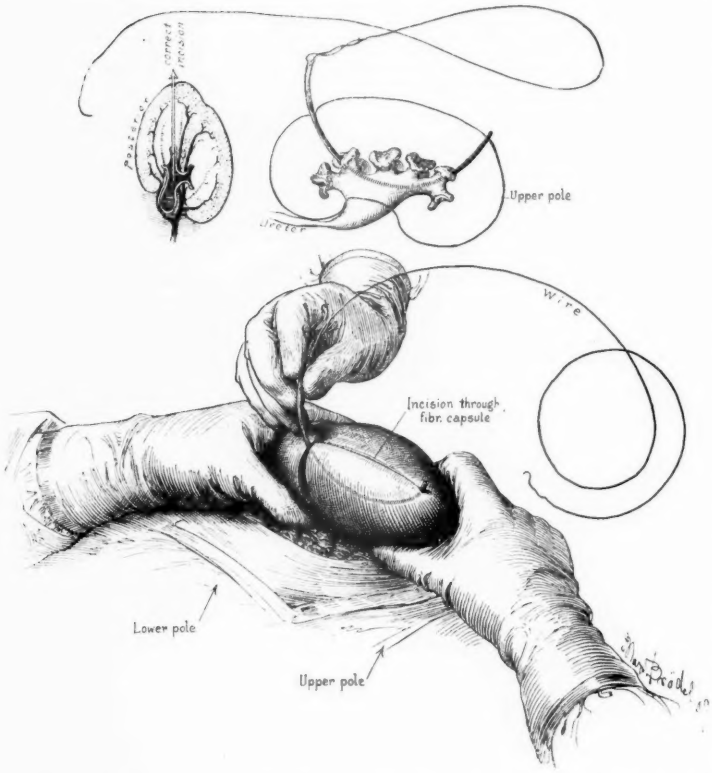

Fig. 5. The L-shaped incision made in cases where the radial or posterior oblique incision is insufficient. The curved needle is reintroduced through the upper end of the first incision, in which manner the operator is sure to get his needle into the pelvis. The upper right diagram shows the point of entrance and emergence of the needle in the pelvis. The upper left diagram shows a transverse view of the kidney and its blood-vessels, and the location of the proposed incision. Note how the posterior papillæ are preserved.

the large renal arterial branches. If exploration is necessary in a kidney with a double pelvis, as mentioned above in the discussion of the topography, two sets of incisions are necessary, as shown in Fig. 9.

It will be evident from the illustrations that in every incision care is taken to avoid injuring either pole of the kidney, as these are so rich in venous plexuses. We have heretofore stated that "*In making any of these incisions with the wire, too much emphasis cannot be placed upon the necessity of firm counter-traction on the kidney, as the wire is being brought to the surface. Sudden or too violent traction might result in the tearing of the main renal vessels.*"

In controlling the bleeding it has been our custom to use manual pressure rather than rubber covered clamps. The assistant holding the kidney can with his thumbs and forefingers readily control any bleeding which may occur.

CLOSURE OF NEPHROTOMY WOUNDS

In our experimental work the wounds were at first closed with two layers of mattress sutures of fine catgut, but we found one single row of mattress sutures of fine black silk preferable. In no instance was there postoperative hæmorrage. The wounds in the human kidney have been closed with two rows of mattress sutures of twenty-day catgut, and the superficial margins approximated with a running or interrupted suture of fine plain catgut (Fig. 10). In placing these sutures straight liver needles were employed. In tying, only sufficient pressure is made to insure good approximation. This readily controls the bleeding and there is very little pressure on the blood-vessels, the greatest strain being limited to the capsule.

The question whether one or two rows of mattress sutures are necessary is best decided by the surgeon who is closing the kidney. Some operators object to the use of mattress sutures on the ground that serious harm results to the circulation of the kidney. This may be so if the sutures are tied too tight.

It is inconceivable that a mattress suture, however tightly drawn, should constrict any of the arteries. It might, however, seriously interfere with the free venous drainage, thus leading to a congestion of the peripheral renal veins, which in turn would become an obstacle to the arterial circulation. The condition may well lead to extensive infarct formation such as various operators claim to have experienced. In the use of the silver wire properly employed the bleeding is essentially venous in character and is readily controlled by light approximation of the two surfaces. The sutures are tied just tight enough to assure this approximation. In the experimental work we were unable to find any ill effects from the mattress sutures used in this manner.

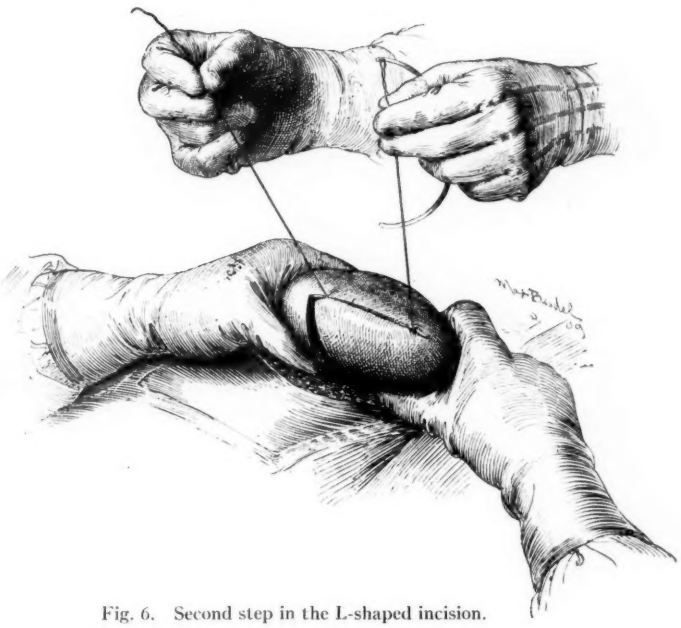

Fig. 6. Second step in the L-shaped incision.

After closure of the kidney wound the organ is replaced into the renal pocket and the line of incision covered as far as possible with the fatty capsule, sutures for this being usually unnecessary. A small rubber protective drain is passed into the renal pocket and the wound closed in layers. No drain ever passes through the cortex into the pelvis.

REPORT OF CASES OF NEPHROTOMY WITH THE SILVER WIRE

In table No. 3 is given a brief account of the results obtained in 19 cases of nephrotomy with the silver wire. While these are in the main satisfactory, still much better results should be obtained when the various operators are more familiar with the topography of the kidney. The careful preliminary examination of the contour and surface markings cannot be too strongly emphasized. Since the application of the wire method in human nephrotomy the technique of the various incisions has been gradually evolved and we feel that the lines of incision as depicted in the illustrations are the most advisable ones.

There has been no severe postoperative hæmorrhage in any of these nephrotomies. It will be seen in reviewing table No. 3 that the urine was bloody or blood tinged for several days. In most instances this was undoubtedly due to old clotted blood which had been deposited in the bladder at or shortly after operation. In order to determine how long postoperative bleeding may occur, we recently in two of our cases (Gyn. Nos. 17,227 and 17,606, table 3) irrigated the bladder with a liter of normal salt solution the morning following operation. The irrigation fluid was returned strongly colored with old blood. For several days the urine remained cloudy, but there was no evidence of fresh bleeding.

To accurately determine the immediate amount of bleeding into the pelvis of the kidney and down into the bladder, we would suggest that the patient be catheterized before leaving the operating table and if any blood be present, this can be flushed out by irrigation with normal salt solution. If on the following morning there is still bloody urine

TABLE III—NEPHROTOMIES WITH THE SILVER WIRE

No.	Name	Diagnosis	Operation	Immediate Bleeding	Postoperative Bleeding
C. H. I. 2–25–09	Mr. S.	Renal calculi (several small stones)	Removal of stones	Slight	Bloody urine for 3 to 4 days.
Surg. 24519	Mr. C.	Renal calculus (small)	Removal of stone	Profuse, 3 small spurting vessels	Some bleeding for 24 hours. No urine note.
Gyn. 15662	Mrs. L.	Tuberculous kidney	Exploratory	Slight venous bleeding	Urine only lightly blood-tinged for a few days.
C. H. I. 1–9–10	Mrs. B.	Pyelitis. Pyelonephritis	Exploratory	One large spurter cut Venous oozing	No note.
C. H. I. 2–26–10	Mrs. W.	Pyonephrosis, renal calculus (small)	Removal of stone	Moderate amount of venous bleeding	No note.
Surg. 25620	Mr. D.	Renal calculus (small)	Removal of stone	Slight	Hæmaturia for 10 days, rubber drainage tube passing through cortex into pelvis.
Gyn. 16500	Mrs. C.	Essential hæmaturia	Exploratory	Free venous bleeding No spurters	Blood-tinged urine 6 days.
Gyn. 16516	Mrs. J.	Hæmaturia, pyuria	Exploratory	Slight venous bleeding	Urine blood-tinged for 5 days.
Gyn. 16598	Mrs. D.	Renal calculi (several small stones)	Removal of stones	Free venous bleeding No spurters	Urine clear on 5th day.
Gyn. 16729	Mrs. E.	Renal calculi (several small stones)	Removal	Very little bleeding (Kidney almost a shell)	No note.
Gyn. 16728	Mrs. M.	Essential hæmaturia	Exploratory	Free venous bleeding	Urine blood-tinged for several days. Clear on 10th day.
Gyn. 16845	Mrs. B.	Renal pain (enlarged kidney)	Exploratory	Slight venous bleeding Two spurters	Urine clear on 4th day.
Gyn. 16598	Mrs. F.	Renal calculus (small)	Removal of stone	Slight venous bleeding	Dark bloody urine for several days.
Gyn. 16968 4	Miss L.	Renal calculus (small)	Removal of stone	Slight venous bleeding (marked thinning of renal parenchyma)	Blood-tinged urine for 3 days. Slight bloody discharge from wound.
C. H. I. 11–23–10	Mr. K.	Renal calculus (large branching stone)	Removal of stone	Very little bleeding; venous in character	No note.
Surg. 27043	Mr. M.	Renal calculi (two small stones)	Removal of stones	Slight	Slight hæmaturia for 48 hours.
Gyn. 17227	Mrs. C.	Enlarged kidney	Exploratory	Considerable venous bleeding. One large vein torn	Urine clear on 4th day. Bladder irrigated day after operation, with removal of considerable clotted blood.
Gyn. 17479	Mrs. W.	Pyelitis. Pyelonephritis	Exploratory	Free venous bleeding. One small spurting vessel	Dark bloody urine for 5 to 6 days.
Gyn. 17606	Miss G.	Renal calculus (small)	Removal of stone	Free venous bleeding One spurting vessel	Urine pinkish-red for four days. Bladder irrigated 12 hours after operation; very little blood in bladder.

All the nephrotomy wounds, with the exception of Surgical No. 25620, were closed with two rows of mattress sutures of catgut and interrupted or continuous superficial sutures.

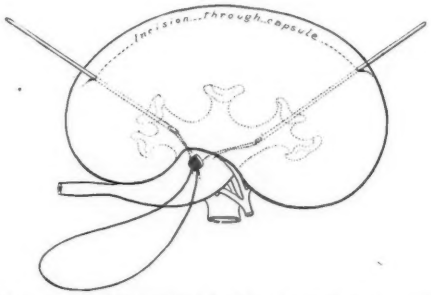

Fig. 7. The longitudinal incision for exploration. The wire is introduced into the pelvis through a short nick on its posterior surface. The silver wire is threaded on a straight liver needle.

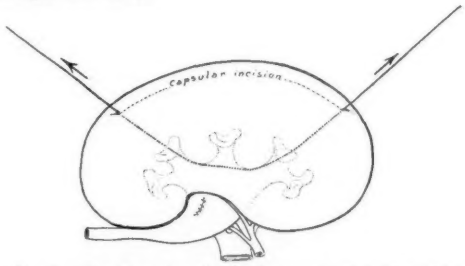

Fig. 8. Showing the wire in the renal pelvis in position ready for the nephrotomy. The pelvic wound is closed.

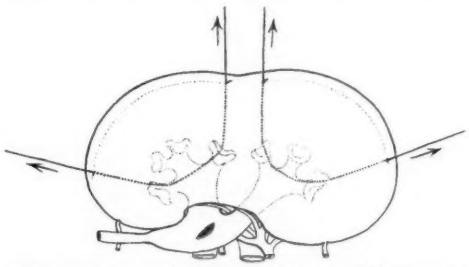

Fig. 9. The nephrotomy incision in kidneys with divided pelvis or double ureters. Two sets of needles and wires are introduced through the same pelvic opening. Thus two separate incisions are made in the manner shown in Fig. 8. This procedure saves the middle portion of the kidney containing large blood-vessels.

present, the irrigation can be repeated. By this means one can definitely determine how long any appreciable amount of bleeding continues. The presence of dark macroscopic blood in the urine for several days does not necessarily mean that postoperative bleeding has occurred over the same period of time.

The following cases (table No. 3) include the nephrotomies in which the wire was used,

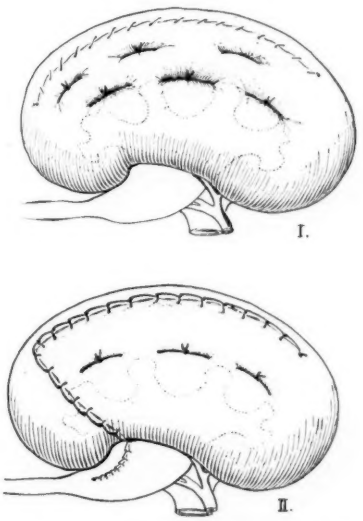

Fig. 10. The sutures of the kidney wound. I. Two sets of catgut mattress sutures are shown, a central row in the vicinity of the calices and a more peripheral one. The capsule is closed with a continuous fine suture. II. Closure of the L-shaped incision, which in this case has been made a continuation of pyelotomy incision. A single row of mattress sutures and a superficial locking suture are employed.

in Professor Halsted's clinic, Professor Kelly's clinic, in this Hospital, and in the service of Dr. Thomas S. Cullen in the Church Home and Infirmary.

CONCLUSIONS

In nephrotomy with the silver wire the following represent the main advantages of the wire incision over that of the knife, as obtained in our experiments.

1. The amount of bleeding at operation averaged only one-half that observed in the knife incision.
2. The bleeding was readily controlled.
3. There was no postoperative hæmorrhage.
4. The resultant infarct was much smaller.

In all our experimental work we have been directed and advised by Mr. Max Brödel and we cannot adequately express our appreciation of his kindly interest. Professor Kelly has aided us in many ways and we are indebted to him for the illustrations. We wish to thank Dr. Harvey Cushing for many valuable suggestions, and Drs. Crowe and Goetsch for their courtesy and assistance.

CONCERNING THE ETIOLOGY OF APPENDICITIS

By JOHN DILL ROBERTSON, B. S., M. D., Chicago, Illinois
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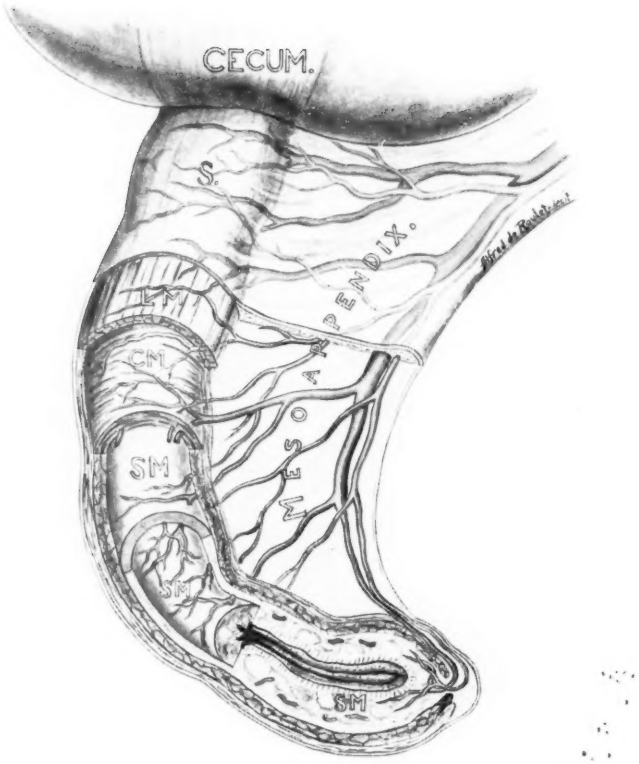
THE etiology of appendicitis, as laid down in the standard books on the subject including the comprehensive works of Deaver and Kelly, is distinctly portrayed. Bacterial invasion of the appendix, especially by the colon bacillus (*bacterium coli comuné, of Escherich*) is now known to be the only cause of the disease. But why the affection should be so prevalent as it is, and just what are the local intestinal conditions and the systemic changes which favor its development, have been questions of debate and fruitful sources for the enunciation of theories which are more or less plausible. We may state at once that the old idea of an invasion of the canal of the appendix by foreign bodies in each and every instance of the disease, especially the presence therein of grapeseeds (*traumatic appendicitis*), has now been abandoned. Except in a very small percentage of the cases, such extraneous matter cannot be found and does not exist. Thus, Kelly states that in 1,000 cases operated upon at Johns Hopkins Hospital in only four instances were foreign bodies found. He quotes 2,527 cases with but 10 due to the presence of foreign bodies—only 2–5 of 1 per cent of the entire number. Murphy found foreign bodies present in 3.5 per cent of his cases, while Fitz and Matterstock found them in 12 per cent of their perforative cases. Ranvier discovered 16 foreign bodies in 459 postmortem examinations, or 3.5 per cent of the cases. It is probable that all cases, perforative and nonperforative, will show but from 2 to 3 per cent as due to the irritation and actual trauma induced by the presence of foreign bodies. To this may be added the slightly larger percentage arising from the presence of fecal concretions (*stercoral appendicitis*). When these cases are included, we find about 12 per cent of the patients operated upon may be grouped under the so-called *traumatic* class. This will leave a very large percentage of the cases which cannot be ascribed to some local traumatic influence.

It is interesting, briefly, to note the various factors that have been advanced from time to time in the effort to elucidate the problem in this large group of cases. Flatulent distension of the colon, forcing fecal matter into the appendix by pneumatic pressure; colonic inflammation, causing occlusion of the mouth of the appendix with retention of irritating substances in its lumen: the deposit of uric acid crystals in the walls of the appendix (*appendicular lithiasis*); habitual constipation; chronic intestinal indigestion; intestinal catarrh; overeating, especially at night; a local (*appendical*) manifestation in influenza and the exanthemata—all have been quoted as predisposing or exciting causes of the disease by various authors at home and abroad. Admitting an etiologic relationship in each and every instance, the mistake lies in misinterpreting the *status quo* of the condition, and in ascribing to a minor or coincidental circumstance the chief or vital rôle in the causation of the disease.

A close and careful investigation of the subject covering a large clinical and surgical experience in appendicitis, has led the writer to a positive conclusion as to the exact etiology of the disease, which may be expressed as follows: Inflammation of the appendix vermiformis, like all inflammations, is associated with vascular disturbances which not only accompany but precede the inflammation. These are the predisposing factors in all forms of appendicitis, except possibly in those rare cases which arise from continuity of mucous structure, as in dysentery and typhoid fever. It will require but a glance at the anatomy of the appendix and the cecum (of which the appendix is a part so far as its muscular structure and vascular supply are concerned) to appreciate the etiologic importance of these vascular disturbances. Merely a superficial examination will show that the muscular fibers of the cecum known as the longitudinal bands of the cecum, and by some designated as the "triband of the cecum and colon," extend down into and



Schematic drawing showing blood supply of the appendix.

completely surround the appendix. In other words, the longitudinal bands of the large gut are continuous with the muscular coat of the appendix. This fact is further, and conclusively, demonstrated by a study of the mode of development of the cecum and appendix. In early fœtal life the cecum and appendix are one, and their structures are continuous, but for certain developmental reasons the upper portion outgrows the lower with the result eventually that we have the larger portion, or cecum, above and the appendix, or undeveloped portion, below. This variation in the development of the two portions is altogether due to a difference in the circulation above and below, the appendix receiving a much smaller blood-supply than the cecum.

The vascular supply of the appendix is derived from the superior mesenteric, through the ileocecal artery, by a branch called the appendicular artery. This vessel traverses a fold of peritoneum behind the ileum to enter the mesoappendix. Running along this small mesentery near its free margin, it sends off several branches across the mesentery, which enter the appendix, and itself finally terminates in the appendix. In women this supply of blood is occasionally supplemented by a small branch of the ovarian artery which traverses the appendiculo-ovarian ligament. This fact, together with the greater freedom from exposure to traumatism enjoyed by the female sex and their weaker musculature, may explain the infrequency of the disease in women as compared with men in the proportion of two women to three men.

Now, the minute arterial branches must pass through the muscular coat of the appendix in order to reach the submucous layer, and the returning small veins pass out the same way. These veins, it must be remembered, are valveless, and surrounded as they are by soft lymphoid tissue without much connective tissue element to furnish support to their thin walls, they are especially subject to compression by any muscular action however trivial it may be. The outer muscular wall of the appendix is composed of the end fibers of the great triband of the colon, and it must, therefore, share at all times in the alternate contraction and relaxation that takes place in the muscle of the large gut. The venous walls consequently are more or less impinged upon by this muscular action and a condition of hyperemia and thrombosis may be readily induced within them. These thrombi invariably precede the attack of appendicitis, and are readily invaded by the microbes which wander into them from the lumen of the appendix. Infection is thus brought about, and an acute attack of appendicitis is precipitated. Muscular contractions of the walls of the appendix may even induce a rupture of some of these minute veins, and Riedel states that "hæmorrhage into the tissue and beneath the epithelium may precipitate a sudden acute attack of inflammation by injuring the tissues."

Lockwood has probably given the best description of the muscular wall of the appendix to be found. He says that "the circular muscular coat is a ring of unstriped muscular fibers about one millimeter thick. It has a dense appearance because it contains hardly any connective tissue cells and but few blood-vessels." Again, "the subperitioneal tissue and the blood-vessels, nerves, and lymphatics which it contains are very intimately connected with the submucosa. This union takes place at certain gaps in the muscular coat, which gaps serve for the transmission of blood-vessels, nerves, and lymphatics from the mesoappendix to the mucous coat." "In proportion to the thickness of their walls the lumena of the appendicular veins are of vast size, and it may safely be inferred that they easily become distended with blood. Their anatomical relation to the rest of the portal system is also calculated to conduce to venous engorgement." "Owing to the stagnation of the blood stream, clots are nearly always present in the appendicular veins in acute infective appendicitis with perforation or gangrene and, in the absence of valves, these clots can easily spread and become detached."

These quotations from a prominent investigator present a vivid picture of the minute anatomy of the appendix and clearly indicate how readily vascular disturbances may be induced in the appendicular walls by muscular action. When we remember that upon

the triband of the colon depends the responsibility of lifting the remnants of digestion up to the hepatic flexure, of pulling the débris over to the splenic flexure, and finally of depositing it in the sigmoid, we will begin to appreciate the amount of alternate contraction and relaxation that must take place in this vessel to accomplish this amount of work, and incidently the tremendous amount of pressure that the appendicular artery and its minute ramifications must be subjected to as it passes through the appendicular wall in order to supply nourishment to the mucous layer. The same muscular action must have a still greater effect upon the venous return, since the walls of the venules are thinner and softer than those of the arterioles and the *vis a tergo* is not so great. Thus it comes to pass that in spasm of the colon, with rigid contraction of the tænia coli, the circulation in the mucosa of the appendix can be completely shut off for minutes at a time. If the contraction be but momentary, enough passive congestion will be induced to give rise to a twinge of appendicular colic; and if this fleeting obstruction be repeatedly produced throughout a protracted period enough interference with the circulation of the appendix will follow to result in deficiency in the nourishment of the organ. There will be produced in this way a progressive condition of appendicular hyperemia which allows large quantities of carbon dioxide to accumulate in the lymph. The protoplasm of the mucous cells is thereby deprived of its normal nutriment, and atrophy and degeneration ensue. This makes the catarrhal form of appendicitis easy of accomplishment through the action of the colon bacillus and other bacteria. At the same time the carbon dioxid, by stimulating the fixed connective tissue surrounding the blood-vessels, will gradually produce an appendicular anemia associated with constriciton and stenosis of the lumen of the appendix. In this manner the stenosing variety of appendicitis is produced, which is characterized by repeated attacks of appendicular colic. If the period of colonic spasm is more protracted, the venules of the appendix will become thrombosed, and a rapid invasion of the thrombi by the colon bacillus or other germs will follow, producing the acute appendicitis with or without pus formation; while if the contraction be prolonged for a sufficient length of time gangrene ensues.

With this fact of vascular disturbance produced by contraction of the appendical walls through the action of the prolongation of the triband of the colon well established, it is easy to note how the various causes to which appendicitis has been ascribed may act. Chronic constipation and intestinal indigestion, by producing venous stasis and intestinal tormina, result in a pronounced venous congestion with stasis of the circulation. Action of the triband now results in thrombus formation, the germs gain entrance and the disease is engendered. Adhesion of the appendix to the surrounding inflamed structures results in the same thing. The venous circulation is interfered with at once, and there is now a ready avenue of entrance for the germs through the inflammatory exudate of low vitality. The reason why the disease is more common in the young is because the muscular structure of the body, and that of the colon and appendix as well, is at its best at this age and can act most effectively in occluding the circulation in the appendix. In advanced age there occurs the usual decline in the efficiency of the muscular tissue generally.

CONCLUSIONS

From the foregoing study the following conclusions may be definitely drawn:

1. The muscles of the colon and appendix are an entity.

2. Muscular contraction in the colon and cecum, whether of the circular fibers or of the longitudinal bands, must be associated with a simultaneous contraction of the muscular walls of the appendix.

3. This contraction is induced by nerve stimulation, the stimulant being presented by the various tabulated predisposing factors as enunciated by many observers, all of which can be accounted for in this one general cause.

4. While the normal muscular contraction and relaxation of the appendix act only to support circulation, when spasmodic in nature it overdoes the matter and produces vascular disturbances.

5. Owing to the peculiar anatomic structure of the appendix, all that tissue within the circular muscle fibers, being spongy in nature, becomes during the abnormal contraction a veritable dam in which the blood is retained until released by the subsidence of the spasm.

6. According to the intensity of the spasm will depend the degree of mucous membrane varicosity and edema, and thus will be determined the varying degrees of inflammatory action.

7. If the spasm be of the mildest degree only, then appendicular colic will result; if of the maximum intensity, gangrene will follow.

8. It may therefore be concluded that atrophy, degeneration, hyperemia, congestion, hyperplasia of connective tissue, and thrombus formation occur *before*, and not *after*, bacterial invasion of the walls of the appendix.

A CASE ILLUSTRATING THE OCCASIONAL ADVISABILITY OF RESECTING TUBERCULOUS GLANDS OF THE MESENTERY

By K. W. MONSARRAT, M. B., F. R. C. S. (Edin.), Liverpool, England
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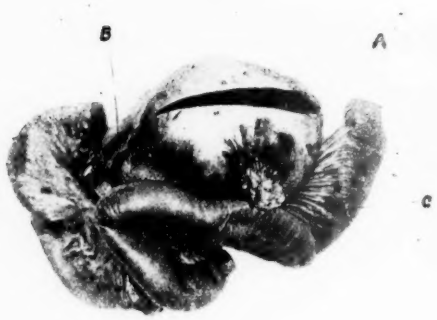
THE lymphatic glands of the mesentery fall into two groups, the juxta-intestinal group and a second group associated with the primary branches of the superior mesenteric artery. The juxta-intestinal glands are situated close to the intestinal insertion of the mesentery. They are normally of small size and according to Poirier and Cunéo they rarely retain artificial injections of the lymphatics. The second group is situated along the primary branches of the superior mesenteric artery and its first anastomotic arcade. They are larger than the previous group and are to be looked upon as the regional glands of the jejunum and ileum. A third group around the trunk of the superior mesenteric artery is not particularly associated with the small intestine but receives the lymphatics of parts of the large intestine, of the duodenum, and of the stomach.

It is well known that the mesenteric glands may be profoundly affected with tuberculosis without recognizable tuberculous lesions in the bowel or peritoneum. In most cases of the disease it is the second regional group of glands which form the masses clinically palpable on each side of the spine. It appears to be unusual for the juxta-intestinal glands to be affected to the extent of forming the large and comparatively isolated tumour-like mass which was found in a case I have to relate. It is stated by physicians that many cases of well marked tabes mesenterica recover spontaneously. In view of this fact, and also in view of the situation of the glands which are usually most deeply involved, the presence of tuberculous mesenteric glands will rarely be an indication by itself for operative interference.

There is no doubt that tabes mesenterica in a certain number of cases is an antecedent to tuberculous peritonitis and other abdominal tuberculous lesions. Diffusion may be a slow process, but also occasionally takes place suddenly by the bursting of a glandular abscess. If diffusion threatens and if the glands concerned are in a situation favourable to resection, then the opportunity is presented of rescuing the patient from a perilous position. Nothing short of resection of the segment of the mesentery concerned with its corresponding length of small intestine can be entertained. Enucleation is impossible without compromising the blood supply of the bowel and the opening and draining of a mesenteric abscess is not likely to be followed by a satisfactory result any more than the drainage of any other tuberculous purulent collection. In the case which I have to report a large tumour was present for the most part composed of a massive tuberculous



A. Sac containing pus, omentum adherent.
B. Mass of caseous glands.
C. Resected ileum.

growth in juxta-intestinal glands. One part of the mass consisted of an abscess cavity and at one point in the wall of this cavity there were distinct signs that the pus was likely to make its way out; a complication which would have been undoubtedly followed by a more or less diffuse infection of the peritoneum.

A boy aged 11, of healthy parents, sent to the hospital on March 15, 1911, and gave the following history:

A year previously he commenced to suffer from occasional attacks of colic about the centre of the abdomen; they varied in severity and until three days before admission were not associated with any symptom except that of pain. On March 8th he had an attack and on the 12th he had another of an unusually severe type in the course of which he vomited. He was then seen by a medical man who found an abdominal tumour and proposed his admission to the hospital. The boy was thin and pale. He gave no history of irregularity in the action of the bowels. As he lay in bed a swelling was plainly visible to the left side of and below the umbilicus. It was not attached to the abdominal wall and was movable from side to side and up and down. The lower pole of the left kidney could be felt away from the tumour in the loin. There was no enlargement of the spleen or the liver. The heart and lungs were normal.

The tumour was slightly tender to palpation; it had an irregular curved outline and for the most part was hard and nodular in consistency except in its centre where fluctuation was present and the sensation of a tense cyst. It was however, doubtful whether the fluctuation was given by a collection of fluid or a mass of soft growth. A definite opinion was not reached before operation as to whether the tumour was of the nature of a new growth in the omentum with adhesions, or whether it was mesenteric in position.

On March 17th the abdomen was opened through the left rectus sheath. The omentum overlay the mass and was normal except for firm adhesions to the growth about the centre of its convexity. On ligating the omental adhesions the mass was found to consist of an isolated group of enlarged mesenteric glands. In the centre was a fluctuating area of the size of an ordinary orange which was evidently a sac full of pus, and it was at one point on the lower convexity of this sac that the omentum was adherent. There was no tuberculous peritonitis nor any signs pointing to ulceration of the bowel. As it was possible to remove all the palpably affected glands it was decided to do this, but resection of a considerable length of small bowel was also necessary. Thirty-three inches of ileum were removed together with a corresponding wedge of mesentery. An end to end anastomosis of the ileum was performed. The edges of the gap in the mesentery were sewn together by interrupted catgut stitches and the abdomen was then closed. Unfortunately the boy developed an acute attack of bronchitis on the third day after the operation, which delayed his recovery, and it was not until ten days after the operation that his condition was really satisfactory. He left the hospital on April 24th. On April 3d, 11th, and 19th, he received injections of tuberculin T.R., on the first occasion one ten-thousandth of a mg., on the two latter one five-thousandth. It is intended to continue this tuberculin administration.

The boy was seen as an out-patient on May 13th. He had put on flesh and was free from any abdominal symptoms.

OPERATIVE VERSUS CONSERVATIVE TREATMENT OF CERTAIN FORMS OF BONE TUBERCULOSIS

By THOMAS W. HUNTINGTON, M. D., San Francisco, California

THE issue which is joined between operative and conservative treatment of early bone tuberculosis, at the present time, may be said to concern chiefly the hip joint. In other relations, as the knee, the shoulder, the elbow, and the ankle, early removal of a focus is, by the general surgeon and many orthopedists, regarded as feasible, and such procedure is fully accredited.

The motive which prompts this discussion springs from a fixed belief that clinical methods based upon conservatism and widely approved by the orthopedic specialist are capable of radical revision; and that results may be appreciably improved by early operative measures. In a word, there is a conservatism which does not conserve and in that, conservatism becomes a fetish.

In an article entitled "The Early Operative Treatment of Hip Joint Disease" (American Journal of Medical Sciences, July, 1905), I said, "If an early attack can be instituted upon a tuberculous focus through a channel which will avoid interference with the joint capsule, afford relief of tension and admit of more or less complete removal of infected tissue, such a policy would seem to be based upon sound surgical doctrine."

This thought arose from what was then a matter of belief and which has since become a matter of positive knowledge, that the medullary structure, at or near a joint, can, with perfect impunity, be removed in its entirety; this to be followed by complete repair of the resultant bone defect.

With added experience and with deepened conviction, I feel warranted in applying this statement to tubercular disease in other localities than the head of the femur, toward which my efforts were then directed.

If, in the development of this subject, I appear in the rôle of a propagandist, justification will be sought in work done, the results of which will be submitted to your judgment. My hope is, that other surgeons, to whom the plan here set forth appeals, with faith in the principle underlying it, will aid in confirming my own observations.

After much reading and careful weighing of opinions, I am led to believe that our knowledge of very early bone tuberculosis is somewhat speculative.

Despite the discovery of the tubercle bacillus and its recognition as the chief etiological factor, we still have much to learn of the life history of this many sided disease. Especially is this true of its genesis — its inception.

It is to be regretted that we have no reliable data bearing upon the period of incubation — that interesting interval between the lodgment of the germ — the initial implantation, and the advent of the symp om complex. That certain important structural changes occur during this interval is a foregone conclusion, and it follows as a logical sequence that a perfect concept of the living pathology of this phase of the process would give the clinician an immense advantage.

It is a notable fact that but few autopsies upon subjects dying in the very early stages of bone tuberculosis have been recorded, and conclusions drawn from animal experimentation, where implantation is by artificial methods are probably misleading. Furthermore, surgical intervention has rarely been invoked until the findings denote wrecking of bony structures and more or less important changes in contiguous soft parts.

The X-rays are an invaluable official aid in this connection, but at just what stage of the disease they become available is not altogether certain. Hence, it happens that corrective measures can only be instituted after very definite pathologic changes have occurred.

For the purposes of this occasion, we will accept as satisfactorily proven that the bacillus finds avenue of ingress through the blood stream which carries the infected embolus to its final lodgment in a terminal arteriole.

The location of original foci, in bone and

joint tuberculosis, is generally conceded to be at or near the epiphysis in a very large majority of cases. A few authorities insist that the disease may be of synovial origin, but upon this point I have always entertained grave doubts. The statement of Edward H. Nichols (Trans. Am. Orth. Assn., vol. xi, 1898) is significant and convincing.

"During the past three years, I have examined 150 tubercular joints, from children and adults, from excisions, amputations, and autopsies and never have seen a joint in which, if all the bones entering into the joint were sawed in thin layers, one or more old bone foci were not found. Four times after amputation, in joints simulating primary synovial tuberculosis, careful search of the entire joint failed to detect any connection with a bone focus. But in each of these cases, when the bones were opened, an extensive area of caseation was discovered, and the line of extension into the joint clearly identified." (Fig. 1.)

Let us now review hastily the various stages noted in the progress of the disease. Closely following the lodgment of a tuberculous embolus, there develops an infarct, irregularly cone-shaped, marking the area deprived of its nutrition, with the apex at the focal point. This is associated with two distinct phenomena: first, a degenerative process in the starved area; second, hyperæmia of the surrounding areas.

As a rational working hypothesis, we may assume that the tubercle bacilli rapidly invade the cone-shaped infarct, which affords an inviting field of activity. At the same time, throughout the hyperæmic area, there is developed increased tension within the medullary cavity, which in turn further complicates the situation. This is manifest in joint pain, tenderness, loss of function, and a general inflammatory condition which often extends to adjacent structures, especially to the synovia. This idea is supported by the early appearance of an excess of joint fluid which occurs in advance of synovial invasion by the specific organism. It is well recognized that superabundant joint fluid, so often found contiguous to a tuberculous bone lesion is, in its early stages, absolutely sterile. Its presence, as an early manifestation, can only be accounted for on the theory of contiguous hyperæmia, intrinsic pressure, and interference with the local circulatory function.

A close analogy to this phenomenon is found in the pleural effusion accompanying pulmonary tuberculosis. That careful investigation of a large volume of pleuritic fluid reveals tubercle bacilli in small numbers, as stated by Osler, does not necessarily imply that the pleura is, itself, the seat of a tuberculous process.

Another early structural change, consequent upon this process, is the occurrence of osteoporosis, due to absorption of bone substance within the medullary cavity, which is easily discoverable by the X-rays. It is a matter of common observation that material removed from such environment is frequently sterile. Hence, it may be assumed that the disappearance of the trabeculæ as shown by the cloudy area in the radiogram is consequent upon hyperæmic pressure, and not, as is generally believed, upon the destructive action of the specific organism. It is, of course, understood that, at a later period, tubercular foci may become multiple and finally involve the entire medullary area.

Subsequent changes are so well understood that it is unnecessary to refer only to essential points.

That there may be an arrest during this stage is a matter of common knowledge. In the milder type of cases and in the presence of a high degree of resistance, the infarct, becoming encapsulated, disappears and a spontaneous cure is undoubtedly accomplished.

Unfortunately, this is exceptional, and prolonged chronicity with its multiplicity of incident is the rule.

With the advent of liquefaction, despite nature's effort to wall off the infarct and impede progress, the tendency toward the escape of fluid persists; the small abscess increases in volume, bone necrosis follows, and gradually along the line of least resistance it encroaches upon the cartilage and ultimately invades the synovial cavity. This, to my mind, marks a momentous epoch in the history of the disease. The synovia at once be-

comes the seat of an extensive, rapidly developing, and destructive process. From the clinical standpoint, the complications of this incident are manifold and discouraging, The integrity of the joint is inherently menaced and often hopelessly impaired. (X-ray findings at this stage and danger of infection of acetabulum.)

Even at this point, the resulting condition may remain stationary, until through the agency of fixation and protracted rest, a cure with greater or less joint damage or complete ankylosis may be accomplished. *This again is not the usual experience.* Tension, the *bete noir* of surgical undertakings, again becomes an active factor within the joint cavity. Perforation of the capsule follows, and there is, at once, established an extraneous area of infection, the well known tubercular abscess, more or less remote from the original seat of disease.

Under conservative methods tubercular abscess occurs at one stage or another of hip joint disease according to the best authorities, in from 40 to 60 per cent. So enthusiastic an advocate of rest and fixation in the treatment of joint disease as Hunkin of San Francisco, says that 50 to 60 per cent of his hip cases are complicated by abscess, adding with all consistency, "In my opinion, this does not call for any special change in the plan of treatment."

The complaisance with which tubercular abscess is viewed by the advocate of conservatism, and the nonchalance with which he confesses to its frequent appearance is surprising, if not grotesque, and affords a strong incentive to seek a means of escape from so unfortunate an incident.

As illustrative of this point, I am permitted to recite the following history:

A boy of seven years developed hip disease in May, 1909. He was at once placed under the care of a local physician who treated him by traction in bed, and later, by plaster of Paris spica. At the end of six months, he was placed under the care of an orthopedic surgeon of large experience and wide repute, by whose courtesy I was permitted to see the patient and use the following data:

The child was delicate, attenuated and markedly anæmic. For thirteen months, he had worn a plaster of Paris spica, the affected limb being in abduction and full extension. He had been permitted to go about, enjoying open air life and exercise. The radiogram of one year ago shows characteristic changes in the femoral head and neck, though the joint outlines were still in evidence. The one of recent date shows still further changes, joint outlines being almost completely obliterated. Within Scarpa's triangle, there was a bulging eminence marking the site of a tubercular abscess. Joint movement was not determined for obvious reasons. Upon inquiry as to future treatment, the answer was, "a continuance of the past," with the added statement that it would be persisted in for an indefinite period.

In reply to my inquiry as to length of time necessary for a cure, I was told that at least two years would be required. (Entire time a minimum of three years.)

Dr. H. Schwatt of Philadelphia (International Clinics, vol. —, 19th Series) writing upon "Treatment of Abscess in Hip Joint Disease" says: "It is pretty well established that increase in the size of a tuberculous abscess does not necessarily mean an extension of the bone disease, and that the retention of sterile pus does not retard the repair of the bone and joint lesion."

In the next paragraph, however, he calls attention to the great danger of infection as a complication and adds: "The mortality of hip disease is due almost entirely to the immediate or remote effects of abscess."

In view of the unsatisfactory results attending the open treatment of hip joint abscess as shown by Lovett and others, it must be conceded that if operative treatment of this condition *is to be limited to simple incision and drainage*, either with or without curettage of the abscess cavity, strict conservatism must, of necessity, prevail.

The end to be striven for is primarily prevention of abscess formation or, secondarily, in the presence of abscess, a direct attack upon the original site of the disease; drainage of the abscess being only an incident to the more important undertaking.

The most comprehensive citation and analysis of hip joint cases of which I have knowledge is that of Mr. Anthony A. Bowlby, Surgeon to the Alexandra Hospital for Children with Hip Disease, London.

In a paper appearing in The British Medical Journal, June 20, 1908, he reviews 900 cases which were treated by him in the above hospital during 21 years. Thirty-three died, less

than four per cent, and attention is called to the death rate since 1879. Prior to that time, of 384 cases, 100 died, the death rate being twenty-six per cent.

During the period mentioned, he has not resorted to excision of the hip in any case. Treatment in all cases was by rest, traction, fixation, and hygienic measures. No child was discharged from the hospital "unless all active disease was at an end." Patients were required to walk with crutches for a year after leaving the bed.

He opens no abscess except as it approaches the surface and nowhere does he mention operative treatment except by brief reference to hip joint excision, as a last resort. He states that recovery means ability to walk well, but says later, "I admit that too many patients walk with a permanently bad limp." This he attributes to *failure in securing complete ankylosis*. Ankylosis in good position, he regards as a desideratum, if it does not imply an ideal result.

Further than these rather vague generalities, we find no statement or statistics bearing upon such important items as degree of joint impairment, bone shortening, crippling deformity, or period of time over which abscess sinuses persist or treatment is required.

In view of the wealth of material afforded by this institution, it seems a little strange that an effort should not have been made toward the development of a new standard for results, and possibly a more efficient method of treatment.

The foregoing is a fair exposition of the strict adherence to a ritual on the part of a large majority of orthopedic specialists as a body, men of large experience and splendid opportunity for observation, and it must be confessed that with very meager experience and deplorably small material, I hesitate in again provoking controversy with recognized authority.

Within the past few years, Bier's hyperæmic treatment has found many enthusiastic supporters and it may be conceded to possess positive merit in selected cases. In my hands, and I make no pretense to a large experience, it has proven disappointing, and I am sure there are others who share my feeling regarding it.

In the treatment of hip joint, it is hard to see how Bier's technique can be carried out with any degree of efficiency.

The value of tuberculin in the treatment of bone tuberculosis does not appear to be definitely fixed. At least, the weight of evidence from those who have thus far used it systematically is in the main discouraging.

Hewes and Floyd, in the Massachusetts General Hospital publication, October, 1910, record four cases in which the results were encouraging, but their conclusion was that "bone tuberculosis is very resistant to tuberculin treatment, probably due to the presence of a sequestrum; until this is removed, progress is bound to be slow." The intimation is that the agent should be used subsequently to operation, and the query arising from this fact is obvious. Does improvement depend upon the operation, or the tuberculin?

Dr. John Ridlon, Surgeon to the Home for Destitute and Crippled Children, Chicago, has investigated this subject in a most painstaking manner. In a paper read before the Congress of American Physicians and Surgeons, 1910, he sums up his observations as follows: "The best I can say is, that in careful hands, in a well equipped laboratory, it is a harmless method of treatment; that in the vast majority of cases, it is of no appreciable value. In an occasional case, it may seem to be of some help in connection with efficient orthopedic measures." His closing paragraph is significant, "But if my final word be asked, it is this: Tuberculin administered by the clinical method, in harmless doses, is useless; in larger doses, it is both dangerous and harmful."

For many years, it has been my practice to deal with early bone tuberculosis in the condyles of the femur and in the head of the tibia by trephining and curetting the affected areas. My results were satisfactory and there are, at the present time, a score or more of patients within my knowledge who are enjoying almost, if not quite perfect joint function as a result of this procedure.

It has long been my belief that interference with the epiphysial cartilage, at the upper end

of the femur, entails less serious consequences than usually is supposed. In confirmation of this opinion, G. Neuber of Kiel, in a paper entitled "The Treatment of Tubercular Hip Joint Disease" writes as follows; under the head of operative treatment: "In children the epiphysial cartilage can rarely be retained. While this is to be regretted, it is not of great significance as increase in the length of the femur takes place principally in the lower epiphysis."

In 1901, I advanced the idea that the same principle might apply in the treatment of hip joint disease, and in pursuance of this thought, I devised the following plan. Having located the disease in the head or neck of the femur, a fair sized trephine opening is made in the bone cortex below the great trochanter. Through this opening a bone curette is passed and practically all the medullary structure of the neck is removed. The epiphysial cartilage may be perforated without hesitation if location of the focus prompts such a step. Extraordinarily free hæmorrhage will be encountered, but this is easily controlled by packing.

Recently, I have learned the great value of camphor phenol (gum camphor, three parts, to pure carbolic acid, one part) as an application in such cavities. It can be used with the utmost freedom and with perfect safety. The cavity is packed with rather dry camphor phenol gauze, which, in my experience, is the most efficient and dependable of all safe antiseptic agents.

The repair of the bone cavity, after granulation has been fully established, may be expedited and much time saved by the introduction of Beck's bismuth paste. The after treatment by fixation and the use of crutches will extend over a period from three to six months, and measurably may be left to the judgment of the patient.

The possibilities of a late recrudescence following this method would appear definitely minimized as compared with the cures accomplished by conservatism.

This procedure is extracapsular and conforms to every condition expressed in the opening sentences of this paper, viz.: Shorter time required in treatment; relatively large preservation of motion; removal of the menace

Fig. 1. Tubercular synovitis, secondary to bone foci, which were not in evidence until the bone was sectioned. (From Edward H. Nichols.)

of reawakening activity which lies in an encapsulated focus, and absence of risk.

I had not gone far in this undertaking before I was made acquainted with the fact that C. MacNamara, of London, in 1881, had adopted a similar, if not the same procedure.

In my second paper upon the "Operative Treatment of Osteitis of the Head of the Femur" (Surgery, Gynecology and Obstetrics, April, 1906) I quoted from MacNamara as follows:

"In cases of tuberculous disease of the head of the femur, as soon as symptoms are clearly defined and before abscess formation in or about the joint, I am in the habit of boring through the trochanter into the head and neck of the bone. The limb is later encased in a plaster of Paris bandage. It frequently happens that we are unable to remove all the affected tissue, but it seems to me that we may remove a considerable portion, and so alter

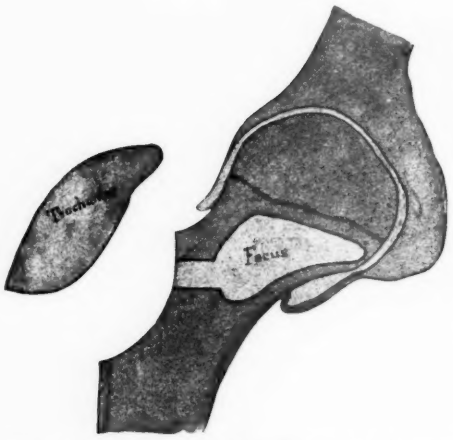


Fig. 2. Illustrating Waldenström's prophylactic operation.

the nature of the inflammatory process as to admit of rapid reparative effort. It is desirable to preserve the cartilage (epiphysial) but we are liable to remove too little rather than too much of the diseased medulla."

In my opinion, he has not sufficiently emphasized "*the rapid changes*" which occur after such an interference. The relief from tension by free drainage is likewise worthy of serious consideration.

With much interest, I have noted the persistency with which orthopedists have opposed this plan, insisting that it is unscientific, irrational, and without justification.

Hunkin of San Francisco (American Journal of Orthopedic Surgery, July, 1906) says: "Although at times men have sought rosier roads to fame and wealth, yet ever has the pendulum swung back to the safe and narrow path of conservatism with rest as its foundation." "My experience has taught me that no surgical plan is so bad and fraught with so much danger as that which holds any radical operation as its base."

Sherman of San Francisco (U. C. Alumni Bulletin, April and July, 1901) makes the following statement: "The hip, the most common location of the initial lesion, is in the diaphysis, close to the epiphysial cartilage; this is most tantalizing, for if the joint was easier of access, it would be common practice among surgeons to cut down on the femoral neck, remove the focus and save the joint. But the joint is not free of access nor can the focus be definitely ascertained . . . and these two facts tend to keep us in the path of strict conservatism."

However, in a personal communication of recent date, Dr. Sherman says: "Since we have discussed the question of operative intervention directed against the focus in cases of hip joint tuberculosis, I have operated upon four patients. Two of these had a perfect healing of their operation wounds, but the rest followed the ordinary course of hip joint tuberculosis. One child died at home about two months after the operation and before she had attempted to walk upon the limb. One child has made, after the operation, and after a fairly long course of treatment in splints, a practically perfect recovery."

Similar expressions from Whitman, Bradford, Lovett, Ridlon, and many others could be quoted in support of non-operative intervention.

I have recently read, with much interest and profit, a monograph by Henning Waldenström of Stockholm, published in 1910, upon the subject of "Tuberculosis in the Neck of the Femur of Children."

The author has had large experience in dealing with hip joint disease and above most writers, seems to have an appreciation of the fact already emphasized, that the strictly conservative method of treatment of this condition does not conform to the spirit of the age.

He agrees with Leonard W. Ely and others that a considerable number of these cases are originally and essentially synovial in origin. He depends both upon the symptoms and the entire clinical picture as well as upon the radiogram to determine the presence of a focus and its location.

He calls attention very forcibly to the long period during which a neck focus may remain isolated as an extracapsular or extrasynovial entity. During this period, there may be intermittent limping, the patient, at times, appearing practically normal, but after too strenuous exercise, symptoms recur, each time becoming a little more important.

It is during this period that he regards the

danger of perforation as extremely imminent. The result of perforation, he recognizes as of great moment, insisting that a tubercular synovitis, once fairly established, menaces, in large degree, the future integrity of the joint.

Waldenström is a firm believer in the efficacy of an early extracapsular attack upon the focus, when it can be definitely located in the neck or head. He believes that this should be undertaken at the earliest possible moment; that is, during that stage when X-ray demonstration is possible and when a definite limp, on the part of the patient, is the most tangible symptom.

What he considers the ideal operation, he describes as follows: Under strict aseptic precautions, he exposes the trochanter major and the portion of bone just below it. He makes a point of clearing out the depression between the trochanter and the neck of the bone. Then, with a small saw, he separates the trochanter from its attachment to the neck and shaft by a curved line, the convexity of the line being toward the neck of the bone. (See Fig. 2.)

Most of the muscular attachments of the trochanter are left intact and the bone flap is carried away from the operative field temporarily. Then, with a small trephine, he forces a passage into the neck toward the head. He then scrapes out that portion of the neck in which he has previously located the focus, removing a considerable portion of the medullary substance of the neck. The cavity is filled with a glycerine iodoform emulsion; the trochanter is then brought back into its normal relation and there fixed by a bit of silver wire passed through the bone to the trochanter. The wound is then carefully closed and the patient placed in a plaster of Paris spica. He terms this procedure a "*prophylactic operation.*" (See Fig. 3.)

In the author's analysis of 80 cases, he states that there were 22 in which neck foci were clearly demonstrated. Ten of these came under observation after the focus had broken into the joint and infected the synovia. Of these ten cases it can be stated positively that eight originated in the neck outside of the joint and that the late synovitis was due to perforation. Six of the 22 cases were observed sufficiently early to admit of the prophylactic operation. In four of these cases, the focus was isolated and by removal, the hip was healed without synovitis and perfect function maintained. In two cases, the focus had broken into the joint a very short time prior to operation. Regarding the outcome of these cases, I quote the author as follows: "I have great hope that in both cases, by removal of the focus, the synovial infection will be overcome and that the result will be practically normal movement in the joint."

In seven cases, the epiphysis was involved and these were treated conservatively. They ran a chronic course and ultimately, the joint became infected. In nine of the 22 cases, a rapidly destructive synovitis was set up.

The author further states that of the 16 cases which had advanced too far for a prophylactic operation, probably ten could have been operated upon as above described and joint function saved if they had come under observation and operation at the proper time; that is, during the early limping stage. Hence, it would appear that of the 22 cases where original foci were in the neck, 16 were clearly amenable to the prophylactic operation, had they appeared at the proper time.

He remarks finally that "*only when doctors and patients understand the import of the symptoms which announce the advent of the disease, at an early period, can we hope to avoid the bad results which so frequently attend tuberculous coxitis.*"

The doctrine which Waldenström has proclaimed conforms absolutely to the feeling which prompted me in my first efforts along this line. So far as I have been able to ascertain, he is the only authority who has expressed this belief, and who has consistently carried out the idea in his practice. The technique of Waldenström's prophylactic operation I believe to be unnecessarily complex. I can see no good reason for deliberately removing the trochanter major for the purpose of obtaining access to the medullary canal of the neck.

The approach to this region by the subtrochanteric route is infinitely simpler and involves less interference with musculature

Fig. 3. End result of prophylactic operation. (From Henning Waldenström).

Fig. 4. Illustrating operative procedure.

and bony structures. Furthermore, I see a very positive advantage in maintaining, for a period of from three to eight days, free access to the resultant cavity. In two of my cases, where, doubtless, the focus was not reached or where it was only partially removed, a purulent discharge occurred from three to ten days after the operation had been completed.

I also am of the opinion that instead of the iodoform glycerine filling of the bone defect, bismuth paste will be found to possess marked advantages.

I wish to now review, rather hastily, the work which I have done along this line; again to call attention to the reasonableness of the undertaking and also, to make a final report showing the present status of the patients so operated.

Two of these histories were published, in detail, in the American Journal of Medicine, July, 1905.

CASE 1. A delicate looking boy, 16 years of age; came under observation, September 6, 1903, with the following history: Was never very robust. Two months ago, contracted a severe cold with symptoms of subacute bronchitis. He recovered from this attack and about five weeks ago began to complain of pain and acute tenderness in the right hip. The pain extended down the thigh to the knee. There was a temperature from 101° to 102°, which has been persistent ever since. Recently, the pain has been very acute, requiring occasional use of morphine. I found him with his right thigh flexed sharply and fixed in that position. He resented any movements of the affected limb. There was marked tenderness and thickening over the great trochanter which otherwise appeared in its normal relation. Weight, 90 pounds. On September 10, 1903, I explored the neck by the method previously described. After trephining the cortex, a curette easily penetrated the neck of the femur to a depth of one and one-half inches. At this point, the instrument dropped suddenly into a well defined cavity filled with thick purulent fluid. The pus cavity admitted the passage of the instrument for a distance of two and one-half inches without resistance.

The entire cavity of the neck up to the epiphysial cartilage was carefully curetted, swabbed out with pure carbolic acid and alcohol, and later, packed with iodoform gauze. The cavity filled rapidly with granulations and the wound was healed at the end of thirty days; at which time, the patient left the hospital. During his residence in the hospital, he gained eight and one-half pounds.

For the following three years, I heard frequently from the patient, the last report being as follows: "There is a small range of motion in the hip joint. I can walk without any crutch or cane." Indirectly, I heard from the patient in 1907, four years after operation, at which time he was continuing to improve so far as joint function and general health were concerned.

CASE 2. A lad of eleven years. Both parents living. Father well. Mother suffered from hip joint disease when six years of age. Now walks with

limp due to a considerable amount of shortening of the affected limb. I saw the patient, July 10, 1904. Was always well until this illness. Has recently ridden a bicycle rather strenuously. At bedtime, last night, complained of a little soreness in right thigh and hip. This morning, symptoms became urgent and the patient was referred to me. When I saw him at noon, temperature was 101°. Right thigh was flexed and rigid. Movements of the affected thigh and foot were sharply resented. Pain chiefly referred to knee. He continued in this condition for two days when, after a careful examination, I located the source of trouble in the head of the right femur. At this time, the patient screamed with pain whenever moved and appeared to be quite ill.

He was placed in plaster of Paris dressing and removed to San Francisco, a distance of twenty miles. I advised trochanteric trephining, which was consented to and undertaken, July 15th, five days after the onset. There was free bleeding of the medullary cavity of the bone and the material removed was extremely hyperæmic. The medulla was removed down to the epiphysial line; no focus was discovered; wound was packed and patient placed in plaster of Paris spica. He ran an indifferent course for thirty-seven days when it was thought best to repeat the operation, going further than at the first effort. This was done on August 22, 1905. The tunneling was carried up to and through the epiphysial cartilage. Again, neither pus cavity nor tuberculous focus was encountered. Wound treatment, as before. On September 5th, fourteen days later, the following record was made: "Last evening, the temperature rose to 101.5°, accompanied by severe pain in joint. This morning, to my surprise, I found patient with a normal temperature, free from pain and altogether comfortable. On removing the dressing, the gauze contained about two drams of thick creamy pus. This appeared to come from a concealed focus in the head of the femur, having escaped along the line of least resistance."

For the following two weeks, there was a discharge of a small amount of pus; the temperature fell to normal and remained so continuously. The knee pain disappeared. Appetite improved, and there was marked general improvement in the patient's condition. On October 1st, the patient was allowed to walk on crutches. At the end of nine months, his limb was almost unappreciably altered in contour, relationship, length, and function.

Fortunately, I have been enabled to inspect this patient frequently up to the present time. His condition is about as follows: Weight 146. The affected hip is, in function and shape, perfectly normal. There is a slight degree of shortening, perhaps one-half inch. The boy is well and strong and in every respect is a splendid exemplification of the method pursued in treatment.

In this case, two things are to be regretted: First, that the original operation was not carried out with sufficient thoroughness. Second, that bacteriological confirmation of the diagnosis was never made. Professor Ophul's report was negative upon the material removed at the time of both operations. The character of the pus which was discharged some ten days after the second operation, through inadvertence, was not subjected to any investigation.

Clinically, the case may be either an example of acute osteomyelitis of pyogenic origin or of tuberculous osteitis of an acute fulminating type as described by Lovett.

Taking into account that his mother suffered from chronic hip disease for many years during her childhood, and the added fact that a sister of the patient has recently died of pulmonary tuberculosis, there is, at least, a fair presumption that our patient's lesion was of definitely tuberculosis origin.

CASE 3. (Published in Surgery, Gynecology, and Obstetrics, April, 1906.) E. C., a girl fourteen years of age, came under observation, May 7, 1905, with the following history: On February 1, 1905, she fell, striking on her left hip. She complained of pain temporarily. On March 1, 1905, she began to limp perceptibly and was admitted to the Sisters Hospital at Los Angeles. She was placed under the care of Dr. E. A. Bryant, who resorted to fixation and traction which was continued until May 7th. Dr. Bryant's diagnosis was tuberculous coxitis. My examination of the patient on May 7th was rather brief, but I found her presenting all the classical signs of tuberculous hip joint disease. There was slight tendency to adduction of the thigh, obliteration of the ileogluteal fold, marked thickening over the great trochanter. Pressure, at this point, was sharply resented. Patient had been seen by several physicians who agreed in diagnosis. Operation had been determined upon before my arrival and was at once undertaken.

Conditions encountered were almost identical with those recorded in the last case. Hyperæmia of removed tissue was very marked. No definite focus was encountered. The wound was packed with iodoform gauze and the patient placed in plaster of Paris spica. For the next three days, she suffered great pain. On the fourth day, pus was found on the dressing. There was a discharge of pus for about ten days; after which the wound granulated and healed finally in about 30

Fig. 5. Illustrating bismuth paste deposit.

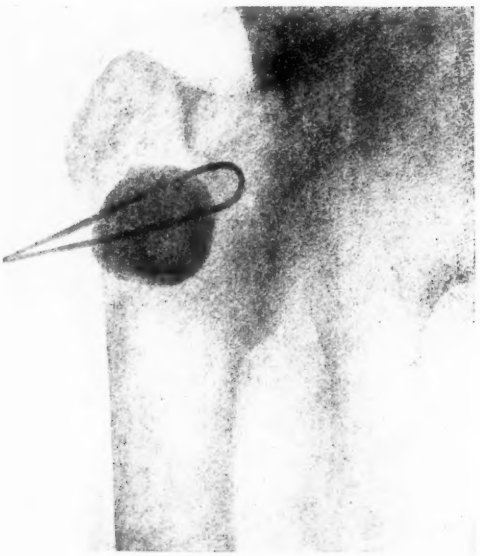


Fig. 6. Same as Fig. 5, after insertion of wire.

days. Again, there was a fault in the bacteriological findings. The material removed, at time of operation, was examined with negative result, and no effort was made to determine the character of the pus when it appeared.

I saw this patient seven months after operation when she was entirely well and could walk and run without a limp. My last report was dated January 14th of the present year, nearly six years after operation, when the patient wrote me as follows: "I never felt better in my life. I weigh 117 pounds; suffer no pain in my hip. There is no stiffness nor lameness nor shortening. So far as I can discover, the affected limb is in perfect condition."

Of the etiological factor in this case, I have never had the slightest degree of doubt, although others have been loth, considering the quick recovery, to admit the correctness of diagnosis on the part of myself and colleagues. Waldenström, commenting upon this case, says: "It is clear that the joint was diseased and the history speaks for tuberculosis, but the rapid cure, after operation, appears very unusual."

I wish especially to call attention to the time occupied in affecting a cure. At the end of seven months, the patient was leading the ordinary life of a school girl; walking, running and playing without restriction. She has continued in the enjoyment of excellent health since that time, and the end result is best expressed by her own letter.

The last case to which I invite your attention is one in which the principle underlying the treatment of the first three cases was carried out in the face of what seemed most discouraging conditions.

The patient was suffering from advanced hip disease of probably six years standing. At the time that I saw him, the head of the femur had undergone marked changes. (See Fig. 5.) The original focus had perforated and infected the synovial membrane and there was a still later development, tuberculous abscess under the fascia lata.

I fully expected, at time of operation, to tunnel through the neck and head and open up the synovial cavity for purpose of cleaning out the detritus, and securing ample drainage. This plan, however, was altered because of conditions which developed during operation.

The history of the case is as follows:

John S., 28 years of age, German by birth, came under my care October 28, 1910. Weight, 145 pounds. Patient's father died at 58 of pulmonary tuberculosis. As a boy, he was robust. Six years ago, when twenty-two years of age, the patient met with a slight accident which was attended with lameness in the left hip for a few weeks. Made a good recovery. Later, he served in the German army for ten months. Came to America four years ago. Three years ago, began to suffer from "hip disease." Entered Lakeside Hospital, Cleveland, Ohio, where he wore a plaster of Paris spica for three months. He improved during this period and was told, at the time of his discharge, that he would go on to recovery. On the contrary, he gradually became worse. When he came under my observation, he was anæmic, but well developed. Heart examination was negative. Examination of the lungs was negative except for an area of slight dullness over the left upper lobe, in front. At this point, the respiratory murmur was minimized. His left lower extremity was shortened about one and one quarter inches. There was great tenderness over the left greater trochanter and the patient complained of constant and severe pain in the hip joint. There was muscle atrophy of the left thigh and leg, also, flabbiness of the entire musculature of the left leg. He depended wholly upon crutches for locomotion, and experienced great pain in attempting to bear any weight on his left leg. His appetite was poor, eating only under compulsion. The left joint was immovable and flexure or rotation of the thigh caused intense pain. Below the great trochanter, beneath the fascia lata, was a fluctuant area denoting presence of fluid. Position of foot (patient being prone) was normal. Head of femur, in acetabulum. Left ileo-inguinal fold, partly obliterated.

Patient entered the University of California Hospital, October 25, 1910. The tuberculin test was positive. The radiogram showed obliteration of joint contour, though the femoral neck was well defined. An osteoporotic area occupied the neck extending up into the great trochanter.

On October 28, 1910, the abscess below the trochanter was freely opened, curetted gently, freely swabbed with camphor phenol, and packed with camphor phenol gauze. About six ounces of tubercular pus was removed and the diagnosis confirmed by guinea-pig inoculation.

One week later, the abscess cavity being dry and free from pathogenic germs, the subtrochanteric bone area was exposed by a three inch incision. On applying a trephine, it penetrated the cortex almost at a single turn, thereby exposing a small bone abscess in the neck and great trochanter.

Enlarging the trephine opening, the entire cavity was completely excavated with a bone curette. The depth of the cavity (about three inches) was limited by a fair degree of resistance to the instrument at the epiphysial line. The trochanter was also cleaned out. (See Fig. 4.)

Hæmorrhage, during the operation, was excessive and despite careful packing with camphor phenol gauze, it became necessary to remove the original pack and replace it with iodoform gauze during the afternoon of the same day. Camphor phenol was freely used during the entire procedure.

On November 22, 1910, I made the following note: Patient has progressed admirably. Pulse and temperature normal. Patient is now eating, where formerly, he had no appetite. The abscess cavity, originally opened in the side of the thigh, has completely healed. The open cavity in the head of the femur is granulating and there is no discharge of pus. Bacteriological findings show the presence of only a mild bacillus albus infection.

On December 12, 1910, the following report was made: The cavity has remained perfectly clean, being packed lightly with camphor phenol gauze. The external wound has narrowed down so it will admit a small amount of gauze without crowding. To-day, I filled the cavity with Beck's bismuth paste, applying a small compress over the external wound. A bent wire was passed through the paste to the bottom of the cavity and a radiogram secured. This shows very clearly that the wire penetrated the bismuth paste and extended on into the underlying granular tissue for about one-half inch. The bismuth filling was tolerated and the external wound was completely closed on December 22, 1910, ten days after the introduction of the paste. (See Figs. 5 and 6.)

At this time, the following record was entered: Pulse and temperature, normal. Appetite, normal. Free from pain. There is slight tenderness on pressure anteriorly over the head of the femur. He now walks with one crutch and can bear some weight on the affected limb, but is advised against doing so. There is very slight, if any motion, in the joint and the inference is that ultimately, complete ankylosis will be established.

He left the hospital fifty-seven days after the thigh abscess was opened and fifty days after radical bone operation. During the entire procedure, no fixation apparatus was applied. Weight, at this time, 133 pounds.

February 2, 1911. The patient called at my office and the following note was made: Patient can bear considerable weight upon the affected limb and can walk a few steps without crutch or cane, but I still advise dependence upon one crutch. His present weight is 145 pounds. He complains of no pain and his general condition is eminently satisfactory.

I again saw the patient on February 7, 1911, ninety-five days after operation, and made the following record: Patient calls at office, weighing 148¼ pounds, which is a gain of over three pounds in one week and a gain of fifteen and one quarter pounds since he left the hospital. He walks, without any support, very well and does not complain of pain. While lying on his back, he raises his left leg from the bed without any difficulty and without any

assistance or support. There is free movement at the hip joint through an arc of 25°. There is shortening of one inch or more.

Considering the deplorable condition of this patient at the time of operation, and the rapid improvement since, it may be safely assumed that had a similar operation been done three years before, or at the time that he entered Lakeside Hospital, the patient's history would have been recited in different terms.

My own belief is that the following claims can be maintained for this procedure: First. Risk of general infection would have been obviated. Second. Time of treatment would have been minimized from six years to five or six months. Third. There would have been no long, protracted period of illness and suffering. Fourth. Abscess formation, shortening of the limb, crippling and ankylosis would have been avoided.

Finally, considering the very satisfactory outcome of the plan of treatment followed in this case, it seems probable that much of the time spent by the orthopedist, when confronted by conditions similar to this, notably synovial involvement and tubercular abscess, can be modified to a marked degree by a properly directed and skillfully performed operative procedure.

DIAGNOSIS OF HOUR-GLASS DUODENUM

With Report of a Case

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THE diagnosis of chronic duodenal ulcer, thanks to the work of Moynihan and others, has become as certain as of any other abdominal disease, therefore to find at operation the confirmation of such a diagnosis is not unusual at this time. The site of ulcer is often diagnosed, by Moynihan, by certain clinical signs, particularly as regards the time of pain after food intake and demonstrated by that famous operator at operations; but there is a class of multiple duodenal ulcers, particularly hour-glass contractions with pouching of the duodenum due to circular ulcers, yet as far as I know, up to the present time, the diagnosis of such cases of hour-glass contraction, previous to operation, has not been made. Therefore this fact will serve as my apology for the introduction of the following case that recently came under my observation; one in which the clinical diagnosis of the duodenal hour-glass was made positive by the aid of the X-ray, and the shadow shown in the radiograph of the bismuthized stomach, demonstrated, beyond a doubt, that we had to do with two constrictions of the duodenum, with a pouch between them, a diagnosis the correctness of which was demonstrated at operation.

I regret, however, that I can show a tracing only of the shadow shown in the X-ray plate. The radiographer wrote me in answer to my request for photographs of the condition found in the radiograph prior to operation, that the photographer, to whom he had given the plate for prints, in washing the negative accidently obliterated nearly all of the shadows. He sent me, however, a tracing, the reduced photographic reproduction of which will, I hope, illustrate the condition as I will later describe.

Case. C. A. P., Buffalo, N. Y. Occupation, office work, 31 years of age. Entered Sisters of Charity Hospital, December 25, 1910. Father died of pneumonia at the age of 43. Mother's death due to accident. Had three brothers, one of whom died of heart disease, the other of disease of the kidneys. One sister lives and enjoys good health.

The patient experienced no disease of any nature until 1889, when he suffered a severe attack of influenza which confined him to bed for three months. From this time up to one year ago he affirms that he was perfectly well. He then noticed that he regularly experienced pain, became dis-

tressed about two hours after food, belched gas and suffered from an irritating pyrosis, which would continue until the next meal, when the ingestion of food would relieve the pain. Alkaline substances and chewing gum would relieve the pain, distress, and pyrosis. From this time on he suffered no untoward symptoms until six weeks ago when he began to vomit and lose weight. The pain since then has come on immediately after food. The vomiting is copious, but contains no blood. There would occur in the vomitus, food that had been ingested three or four days previous. There was no occult blood in the stool. The pain is not severe at any time. The vomiting at present is uncontrollable and persistent. Examination of the stomach contents shows a total acidity of 90. Free hcl., 40. Combined hcl., 40; no lactic acid; microscopic yeast cells, sarcinæ and numerous leucocytes. Temperature, pulse, respiration normal. Pulse at times down to 60.

PHYSICAL EXAMINATION

Patient is thin; good bony framework; panniculus adiposis poor; skin pale and anæmic. No abnormality about the head; eyes normal, pupils react to light and accommodation; conjunctiva pale, no icterus. Mucous membrane of the mouth pale, gums pale, not spongy, do not bleed; teeth well preserved; neck emaciated, no enlargement of the glands of the neck. No abnormal pulsation. Supraclavicular glands not enlarged. Lungs and heart normal. Axillary glands not enlarged.

Abdomen. The abdomen is flat, there is no tumor to be seen, palpation shows no tumor but it does show rigidity of the right rectus above the umbilicus. Percussion of the stomach shows the lower border about an inch below the umbilicus. There are some distinct peristaltic waves. There is no tenderness in the right iliac region. Bowels are constipated. Kidneys, normal. Urine, alkaline, contains phosphates. Reflexes, normal. Blood examination shows secondary anæmia, hb. 60 per cent. No nucleated red cells. Weight 106 pounds, or loss of 40 pounds in a year.

Considering in this case, (a) the persistent vomiting, (b) nature of the vomited matter, i. e., the food particles eaten three or four days previous, (c) the positive peristaltic waves, and (d) the presence of sarcinæ, the diagnosis of motor insufficiency due to obstruction at the pyloric outlet was classically demonstrated; added to this the fact that there was, (a) free hcl. with hyperacidity, (b) no lactic acid nor Boas-Oppler bacilli, (c) no tumor palpable at pylorus, (d) normal or subnormal pulse rate (which I personally consider in all such cases as against malignancy), (e) no nucleated red cells in the blood

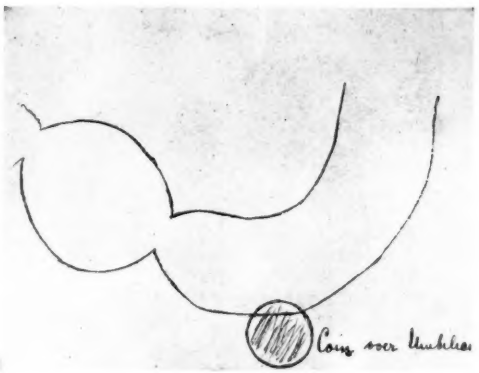

Fig. 1.

examination, it was manifest that the stenosis was benign; further, the fact that the pain, distress, and gas came on regularly, in the beginning of the illness, two hours after food intake and which were instantly relieved by the ingestion of food, led us to conclude that we had to deal with chronic duodenal ulcer, as the causative factor of this benign stenosis of the stomach outlet. After we arrived at this clinical conclusion, we gave the patient two ounces of bismuth subcarbonate in suspension; after five minutes a radiograph of the abdomen was made and the following found: The greater curvature of the stomach appeared regular in outline, about one finger-breadth above the umbilicus, to the pyloric outlet, where there appeared a sharp indentation; continuing from this indentation the border appeared as the lower boundary of the large, round, symmetrical shadow where at the extremity of which it formed another indentation. The upper border of the stomach was regular in outline, until it reached the pyloric end, where it also became indented so that apparently it formed a narrow constriction with the lower border; the upper border continued from this point and formed the upper boundary of this large symmetrical shadow, both upper and lower borders converging again and forming a second constriction in the duodenum. I append herewith a tracing of the X-ray plate. (Fig. 1.)

Considering our clinical diagnosis of benign

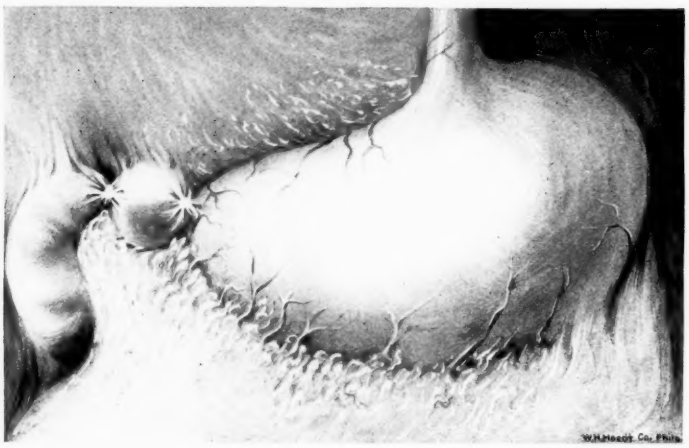

Fig. 2. We found after opening the abdomen that there were two circular ulcers of the duodenum, one just beyond the pyloric ring as evidenced by the situation of the pyloric veins, the other ulcer about one and one half inches beyond the first one. Between these two constrictions was a soft, boggy, globular mass, the diameter of which was about one and one-half inches. There was a pouch between the two circular ulcers, in other words, a double duodenal stenosis or hour-glass duodenum. The lower border of the stomach was about an inch below the umbilicus. The stomach itself was dilated.

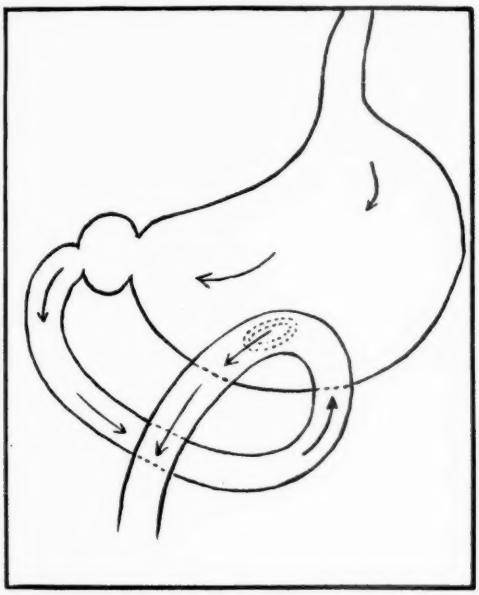

Fig. 2a. The stomach showing a short loop posterior gastrojejunostomy to the most dependent portion of the stomach, the line of anastomosis diagonally from left to right on the posterior wall of the stomach.

constriction, due to duodenal ulcer, the only interpretation we could make of the X-ray plate was that we had to do with two ulcers, one near the pylorus, the other beyond the globular shadow, and that this shadow was a dilated pouch between them, in other words a dual stenosis or hour-glass duodenum, a diagnosis which we demonstrated at operation. We found after opening the abdomen that there were two circular ulcers of the duodenum, one just beyond the pyloric ring as evidenced by the situation of the pyloric veins, the other ulcer about one and one-half inches beyond the first one. Between these two constrictions was a soft, boggy, globular mass, the nature of which I was at a loss momentarily to explain, but upon reflection concluded that it was the pouch filled with bismuth paste which had been ingested the day previous to X-ray examination and had not been washed out during the stomach lavage nor passed on beyond the second constriction, into the bowel. I found also that the lower border of the stomach was about two finger-breadths lower than the umbilicus, showing that the X-ray shadow was that of the contracted stomach and not

Fig. 3.

of its relaxed state. (Fig. 2.) I made a posterior gastrojejunostomy with a three inch stoma using an inch and a half loop, and did not attack the ulcers, a proceeding which has proved, in this case, thus far, very satisfactory.

To-day, four months after operation, the patient shows a gain of 45 pounds; he has not vomited, nor experienced any other digestive disturbances since the gastrojejunostomy was made. Figs. 3 and 4 show conditions four months after operation. The first radiograph was made immediately after the ingestion of bismuth subcarbonate suspension, the second five minutes later than the first one. They both show the dual stenosis in the duodenum with pouch between; also the bismuth going through the new opening into the jejunum. Inasmuch as I made the anastomosis as close as possible to the pylorus without including any of it, I can readily identify particularly in Fig. 3, the pylorus, the first constriction in the duodenum one inch beyond the pylorus, and the second constriction, an extremely narrow one, about one and one-half inches beyond the first constriction; beyond the second narrowing the normal duodenum coated with some of the bismuth which has been injected through both the stenoses into the bowel. There can be seen also bismuth shadows showing how quickly through a posterior gastroenterostomy the contents of the stomach are emptied into the intestines. The efferent

Fig. 4.

jejunal loop shows itself going from left to right following the direction of the line of anastomosis to the posterior wall of the stomach according to Moynihan's idea of some years ago; the Moynihan line from left to right and downwards on the stomach wall is correct in this case as the jejunal loop used in the anastomosis is a short one, about one and one half inches from the plica. (Fig. 4.)

It is sometimes observed in cases of stenosis of the pyloric outlet due to the cicatrization of the duodenal ulcer, or periduodentic adhesions that when the stenosis begins, the time of the occurrence and the character of the pain and distress change, and we find in such cases instead of coming on two hours after food and regularly, they come on consistently, immediately after and remain almost continuous until vomiting takes place. This was shown in a characteristic manner in the anamnesis of our case; the patient affirmed that only six weeks ago when signs of obstruction began to appear, that he experienced pain immediately after eating.

THE BLOOD SUPPLY OF THE DUODENUM[1]

With Special Reference to the Supraduodenal Artery

By D. P. D. WILKIE, M. Ch., F. R. C. S., Edinburgh, Scotland
Assistant to the Regius Professor of Clinical Surgery, Edinburgh University

IN studying the surgical pathology of the duodenum it has been repeatedly brought home to the writer that certain of the pathological conditions found could best be explained by a deficiency, or at least by some peculiarity, of blood supply in the first part of this segment of bowel.

Chronic ulceration in other parts of the body is usually found in association with vascular insufficiency, e. g., ulceration in the lower third of the leg, and the impact of the acid chyme from the stomach against the wall of the first part of the duodenum has always appeared to me to be a peculiarly unsatisfying explanation either of the origin or of the chronic course of a duodenal ulcer.

The liability to leakage after suture of the first part of the duodenum in the operation of pylorectomy also suggested a paucity of blood supply. Lastly, the fact that, anatom-

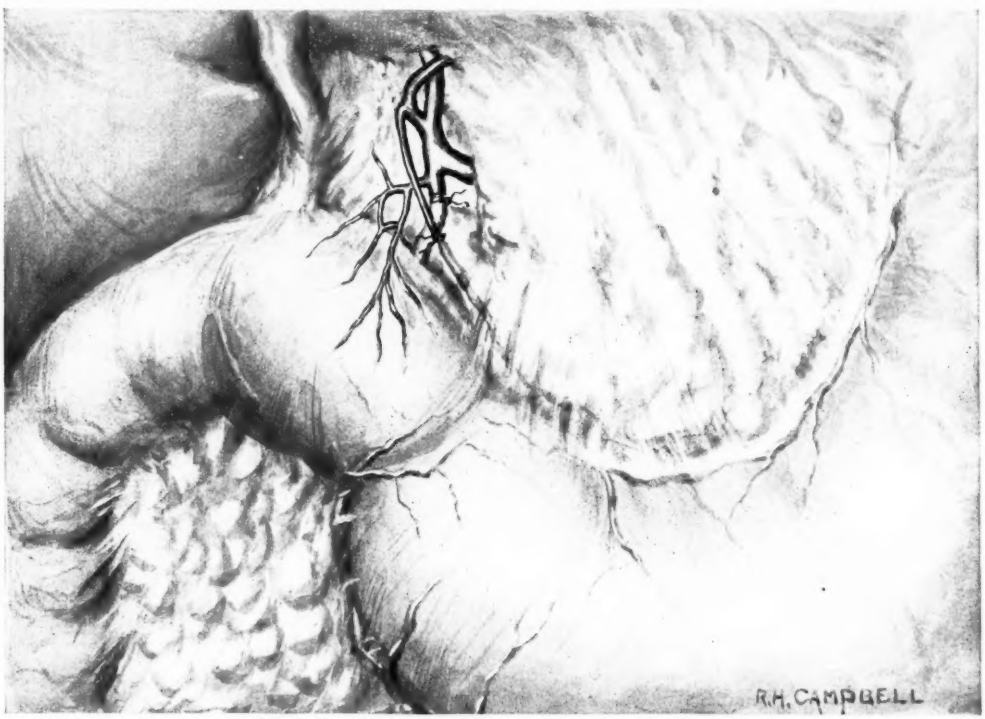

Fig. 1. Injection of cœliac axis artery after ligature of coronary, pyloric, and gastroduodenal arteries. The supraduodenal artery arising from the start of the gastroduodenal and supplying the first part of the duodenum is well seen.

Note.—These drawings were made from dissected specimens after removal from the body. The liver was thrown upwards and consequently the space between it and the stomach and duodenum appears unduly great.

[1] From the Pathological Department of the Edinburgh Royal Infirmary.

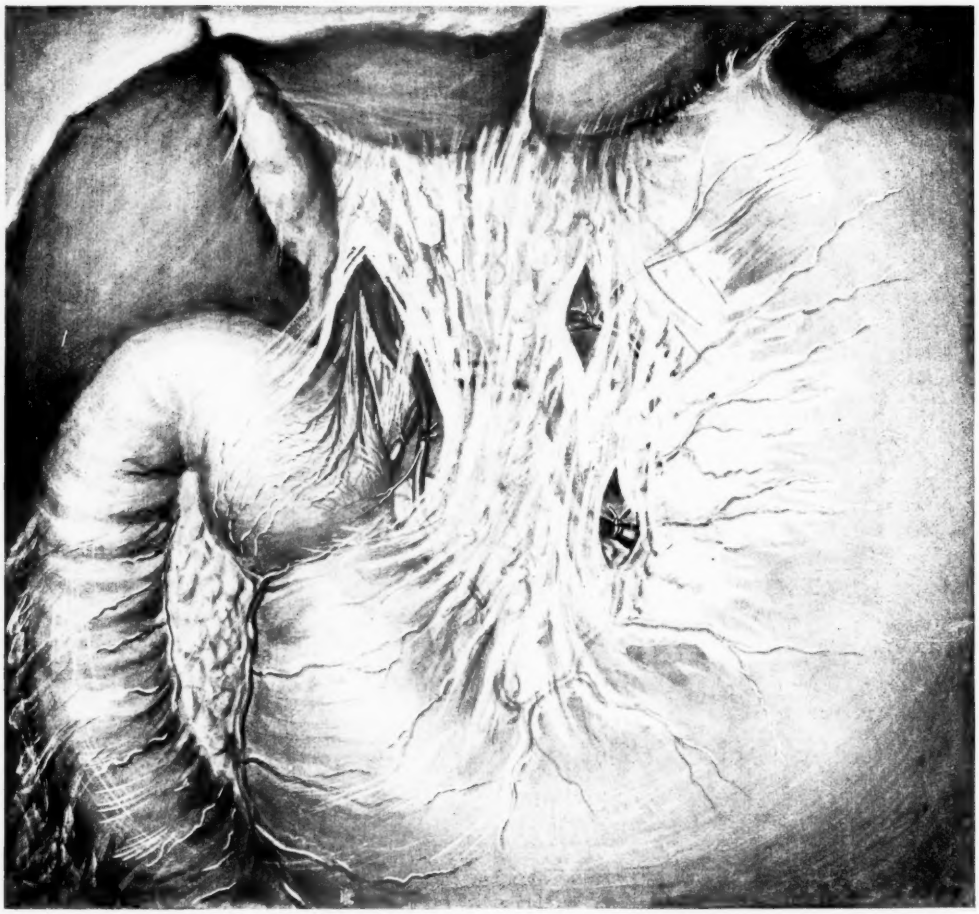

Fig. 2. Supraduodenal artery arising from the right hepatic branch. In this case the vessel appears to be an end artery.

ically, the first portion of the duodenum is situated on the borderline between the areas supplied by the cœliac axis artery on the one hand and by the superior mesenteric artery on the other, afforded some foundation for the theory of vascular insufficiency.

In the standard works on anatomy the question of the blood supply of the duodenum is dismissed in a few words. The two pancreatico-duodenal arteries assisted by a few twigs from the pyloric artery are accredited with the blood supply of this important segment of intestine.

I have made a number of injections of the arteries supplying the upper portion of the gastrointestinal tract which clearly show that a fuller description of the arterial supply of the duodenum than that given at present by anatomists is necessary, and, indeed, that the part of the duodenum which is of greatest interest from the pathological and surgical standpoints is supplied by vessels which anatomists have hitherto neglected to describe.

In order to determine how free was the anastomosis between the cœliac axis and the superior mesenteric arteries I injected in

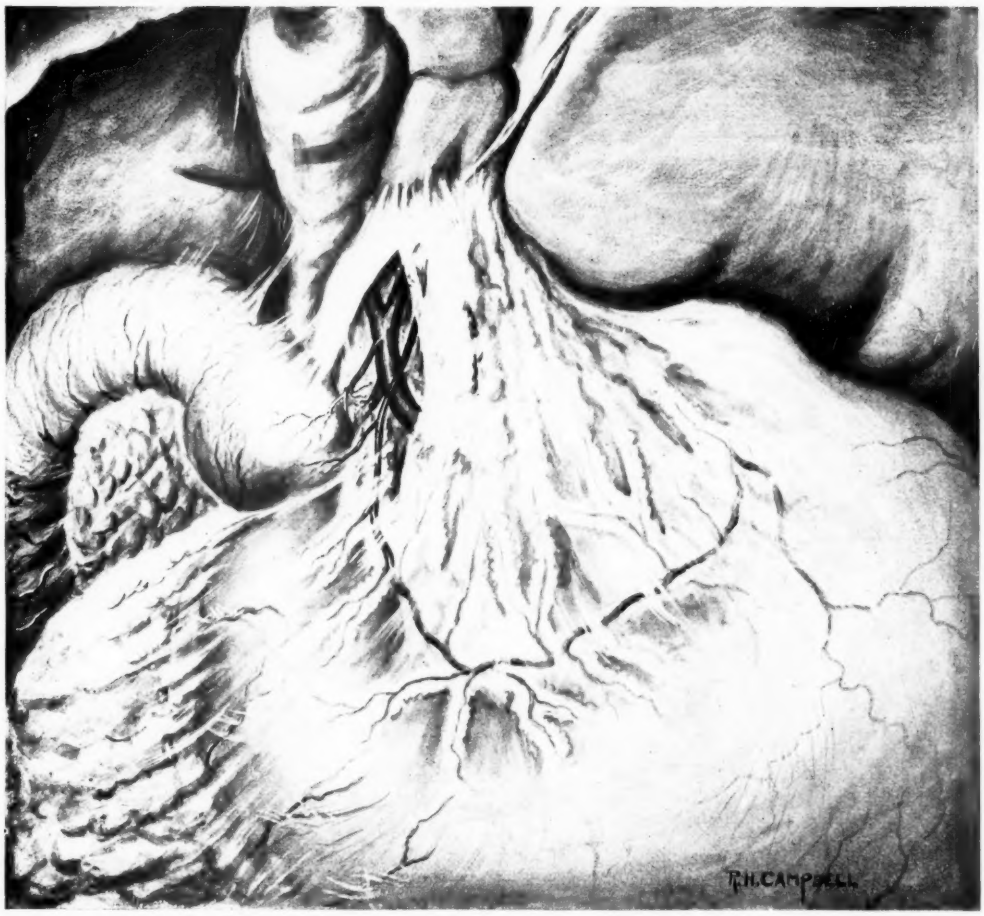

Fig. 3. Injection of cœliac axis artery after ligature of the supraduodenal artery, showing area of pallor on first part of duodenum. Note origin from hepatic artery.

several bodies the gastroduodenal artery, and in several others, the superior mesenteric artery. When the gastroduodenal artery was injected, the medium (a suspension of starch and vermilion in distilled water) travelled freely into the vessels of the second, third, and fourth parts of the duodenum and those of the first few feet of jejunum. The first part of the duodenum, however, showed in many cases a characteristic and striking appearance, namely, that an area corresponding to the upper half of the first one and one-half to two inches of the duodenum, remained uninjected.

Injection of the superior mesenteric artery after ligature of the gastroduodenal artery showed that there was a free anastomosis between the two pancreatico-duodenal arteries, and gave a plentiful injection of the duodenum up to its first part, but failed to inject the "critical area," i. e., the upper two-thirds of its first part.

I imagined, therefore, that this area of the first portion of the duodenum must be

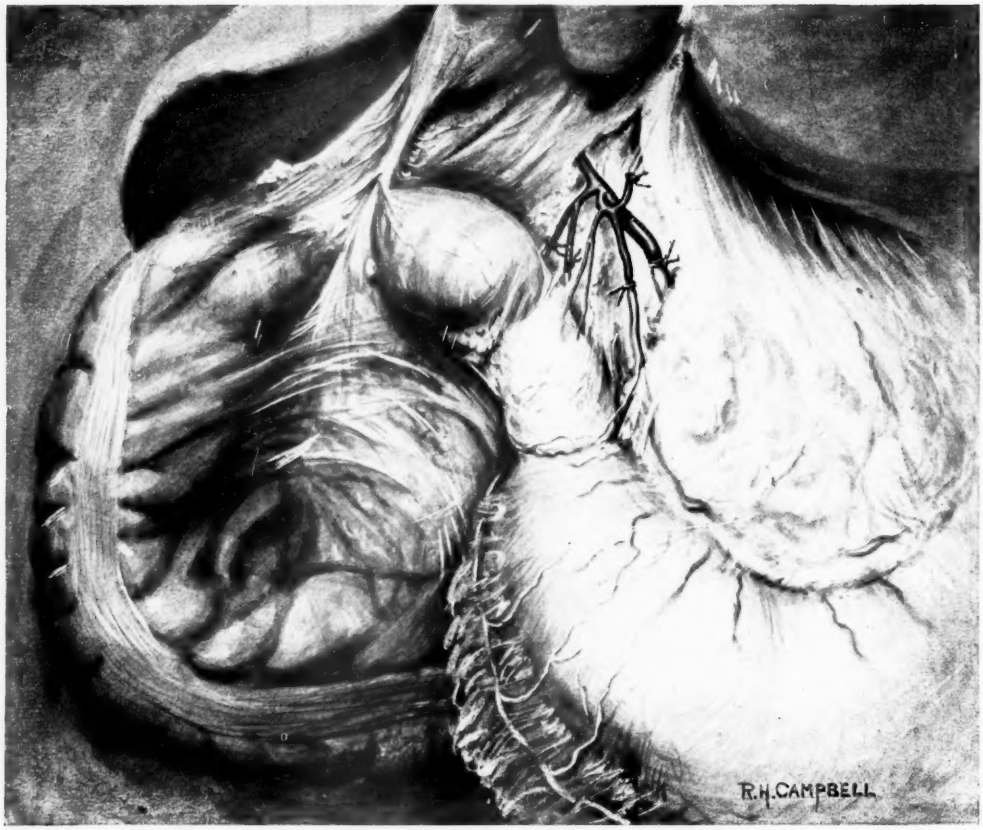

Fig. 4. Stenosis of first part of duodenum the result of chronic ulceration. Supraduodenal artery, arising from left hepatic branch, seen running downwards to the pathological area.

supplied by the pyloric artery, and accordingly, in several bodies, injected this vessel. These injections revealed that the pyloric artery frequently sends one or more branches to the upper part of the first one-half to three-fourths of an inch of the duodenum, but does not supply the whole of the critical area. In one of these cases where I had ligatured the hepatic artery at its origin, and also ligatured the gastroduodenal artery half an inch beyond its origin, and then injected the left hepatic branch in a central direction, besides injecting the pyloric artery, two slender vessels arising from the gastroduodenal artery, just after its origin from the hepatic, and running downwards to the first part of the duodenum were injected, and these vessels were seen to supply the critical area, and to have little or no anastomotic connection with the other duodenal arteries. Was this an atypical case or was this area of duodenum normally supplied by one or more special vessels which had hitherto escaped the attention of anatomists? To settle this question a number of differential injections of the arteries in this region were carried out, and these proved, to my mind conclusively, that the "critical area" of the first portion of the duodenum has normally an independent source of blood supply.

In a number of bodies the following procedure was carried out. Ligatures were

applied to the coronary, splenic, pyloric, and gastroduodenal arteries. In the case of the gastroduodenal artery, the ligature was applied at a point one-half to three-fourths of an inch beyond its origin from the hepatic artery. The cœliac axis artery was then injected and *in every case the upper two-thirds of the anterior wall of the first part of the duodenum, and the upper third of the posterior wall in the same area were injected.*

It was an easy matter now to trace the origin of this source of supply. In every case the arterial branches descended over the duodenum, from a trunk which had its origin at a higher level than the mid-point of the gastroduodenal artery. This vessel I have ventured to call the "supraduodenal artery." Its origin is variable, and whilst in the majority of the cases examined, it arose from the upper part of the trunk of the gastroduodenal artery, in other cases it was found springing from the common hepatic trunk, from the right or from the left hepatic branches, or from the cystic artery. In these cases, when injected, it formed a very striking picture and impressed one with the precarious nature of the blood supply of this part of the intestine.

In the majority of the cases injected, the supraduodenal artery had no communication of any size with any other gastric or duodenal artery, and the application of considerable force failed to drive the injection beyond this limited area of the duodenum. In these cases the supraduodenal artery appeared to be an end artery. In some cases however, twigs communicating with the pyloric artery or with the duodenal branch of the right gastroepiploic artery were plainly visible; the anastomosis was however never a very free one.

The sources of origin of the gastroduodenal artery in forty cases, injected in the method described above, are summarized in table 1.

ORIGIN OF THE SUPRADUODENAL ARTERY IN FORTY BODIES INJECTED BY THE DIFFERENTIAL METHOD

	Cases
From the gastroduodenal artery	22
From the right hepatic branch	7
From the left hepatic branch	5
From the common hepatic trunk	2
As a large branch from pyloric artery	1
From the cystic artery	1
AS TWO VESSELS	
From the common hepatic artery and the left hepatic branch	1
From the common hepatic artery and the gastroduodenal artery	1
	40

When the supraduodenal artery arises from the gastroduodenal artery it usually takes the form of a short trunk, which, arising on a level with the upper border of the duodenum, soon ends by dividing into a spray of branches giving a characteristic fountain-like appearance, the branches for the most part arching over to the front of the duodenum. In three cases the supraduodenal vessel was of large size and ran outwards along the upper border of the duodenum for several inches, sending numerous branches to both its anterior and posterior walls.

In four of the forty injected cases, there was definite evidence of old duodenal ulceration, undiagnosed before death. In one case this was so definite as to have produced a marked stenosis of the first inch of the duodenum. (Fig. 4.) In three of these cases the scars of the ulcers were situated on the anterior wall of the duodenum in the area supplied by the supraduodenal artery and the branches of this vessel could be traced into the scar tissue, and appeared to have little or no anastomotic connection with other duodenal vessels. The origin of the supraduodenal artery in these three cases is of interest. In one case it arose from the left hepatic branch, in another from the common hepatic trunk, and in the third case it was represented by two vessels, both arising from the right hepatic branch and running vertically downwards. In the fourth case the scar was situated on the upper border of the duodenum half an inch from the pylorus. In this case injection of the cœliac axis artery, without ligature of its branches, failed to inject the first three-quarters of an inch of the upper border of the duodenum, even after considerable force had been applied, and left an area of pallor in the apparently healthy duodenal wall around the scar. On dissecting this specimen a small supraduodenal artery was found arising from the gastroduodenal artery. It sent only one small branch

to this pale area which also received a small twig from the pyloric artery. This case illustrated a point which will be referred to later, namely, that the first three-quarters of an inch of the upper border of the duodenum has a very indifferent arterial supply.

The supraduodenal artery is difficult to identify in the living human subject. Its position is indicated by the corresponding veins [1] which are always visible arching upwards from the duodenum in the fold of peritoneum which stretches from its first part to the liver, a fold on which Lane has laid stress in connection with its relationship to duodenal ulcer. Whatever be its point of origin, the artery soon divides into several branches. One of these, a small one, usually runs upwards in the gastrohepatic omentum; the larger branches descend to the anterior wall of the duodenum, one or more small branches going to the upper part of the posterior wall.

In several cases a ligature was applied to this vessel and the cœliac axis artery was then injected. In these cases an uninjected area was left, and this corresponded almost exactly to the limits of the critical or ulcer bearing area. (Fig. 3.)

In the majority of cases a second artery was found, springing from the gastroduodenal about half an inch above its bifurcation, and supplying the posterior wall of the first part of the duodenum and sometimes reaching to its second part. This vessel, though not constant, was generally present and I have ventured to name it the retroduodenal artery.

The lower third of the anterior aspect of the first inch of the duodenum is supplied by a branch which, arising from the right gastro-epiploic artery or from the superior pancreatico-duodenal artery, turns upwards about one-quarter of an inch to the right of the pyloric vein of Mayo.

RELATIVE VASCULARITY OF DIFFERENT AREAS OF DUODENUM

Having by means of differential injections identified these vessels and the areas they supplied, the writer, in a number of cases, injected the cœliac axis artery to determine the relative vascularity of the different areas of the first portion of the duodenum. These injections demonstrated that one area, namely, the first one-half to three-quarters of an inch of the upper border of the duodenum, especially on its posterior aspect, has, in many cases, a relatively poor arterial supply. In most of these cases no branch from the pyloric artery reached the duodenum, and the supraduodenal artery sent but a small twig to this area. Thus, whilst in the injected specimens incisions made into the pylorus showed that the vessels in this region were freely injected, in the area of duodenum just beyond the pylorus there was a striking pallor, and the vessels in this area appeared to have few if any anastomotic connections with the pyloric branches. This is of interest in view of the fact that this area of the duodenum is probably the commonest site of *perforating* ulcer.

To sum up, the blood supply to the first part of the duodenum is derived from the following sources:

1. The supraduodenal artery (of varying origin) supplies the upper two-thirds of its anterior surface and the upper one to two-thirds of its posterior surface.

2. Branches from the pyloric artery, in about fifty per cent of cases, supply the first one-half inch of its upper border with adjacent portions of its anterior and posterior walls.

3. The recurrent branch from either the right gastroepiploic or the superior pancreatico-duodenal artery, supplies the lower third of the anterior surface of the first inch of duodenum.

4. The retroduodenal artery, a branch from the trunk of the gastroduodenal artery, usually supplies the lower two-thirds of the posterior surface.

5. Branches from the superior pancreatico-duodenal artery supply the termination of the first portion of the duodenum. The anastomosis between these branches and the above mentioned vessels is by no means free.

These injections demonstrated also that the arterial anastomosis in the stomach is

[1] These veins usually join the pyloric vein just before it enters the portal vein, but not infrequently they enter the portal vein directly.

much freer in its cardiac end than in the pyloric antrum, and that in the pyloric antrum the anastomosis is better marked along the greater than it is along the lesser curvature. This fact, when taken in conjunction with the extraordinary anæmia which is produced in the pyloric portion of the stomach during spasmodic contraction of this portion, may have a bearing on the etiology of chronic gastric ulcer, and explain, on the vascular theory, its relative frequency in the pyloric antrum.

THE RELATIONSHIP OF ARTERIAL SUPPLY TO CHRONIC DUODENAL ULCER

Whatever be the initial determining cause of a duodenal ulcer, its chronicity, and its tendency to recurrence is probably due to a paucity of vascular supply.

The regularity with which chronic duodenal ulcers are found in the zone supplied by the supraduodenal artery, and the fact that in many instances this vessel appears to be practically an end artery lends weight to this view. In the scar of a duodenal ulcer, a certain amount of periarteritis is invariably found. If the vessels involved in the scar tissue be end arteries, it is not surprising that a tendency to recurrence of ulceration in these cases should be the rule.

The frequency with which perforation of a duodenal ulcer is met with in men of 50 years of age and over, that is, in individuals whose arteries are undergoing sclerotic change, may be explained on the same lines.

Whether a duodenal ulcer is more commonly met with in individuals in whom the supraduodenal artery arises at a high level and runs vertically downwards to the duodenum, and is consequently more liable to strain with narrowing of its lumen, is a point which is worthy of further investigation. Three of the cases of ulcer in my series of injected bodies suggest the possibility of such a relationship.

The frequent tendency of ulcers situated on the upper border of the duodenum just beyond the pylorus, to perforate, is probably due to the poor arterial supply of this area of duodenum which lies between the zones supplied respectively by the pyloric and supraduodenal arteries, the anastomosis between these vessels being, as a rule, of the most meager description.

RELATIONSHIP OF THE SUPRADUODENAL ARTERY TO THE ANÆMIC SPOT OF MAYO

Some years ago, W. J. Mayo[1] drew attention to the fact that in certain cases when the pylorus and first part of the duodenum were pulled down into the abdominal wound, during an operation, an anæmic spot was visible on the anterior wall of the duodenum in the common site of the scar of a duodenal ulcer. The position of this spot corresponds to the center of the area supplied by the supraduodenal artery and in these cases it is highly probable that this vessel, arising at a high level and running down to the duodenum, is put on the stretch, and has its lumen narrowed or obliterated.

BEARING OF THE ARTERIAL SUPPLY OF THE DUODENUM ON THE TREATMENT OF THE DUODENAL STUMP IN PYLORECTOMY

The meager arterial anastomosis in the first part of the duodenum, and the liability of one or more of its leading vessels of supply to be ligatured during the operation of pylorectomy, readily explains the universally recognized danger of leakage from the duodenal stump, after the operation. Such leakage is probably due to necrosis of some portion of the sutured end, and, therefore, should best be avoided by a very generous invagination of the ligated stump.

In conclusion, I desire to express my indebtedness to the members of the pathological staff of the Edinburgh Royal Infirmary for their constant kindness and forbearance in permitting me to carry out these injections in the postmortem room.

[1] Surg., Gyn. and Obstet., vi, p. 600.

CÆSAREAN SECTION

A Study Based on the 104 Operations Performed by the Writer

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CÆSAREAN section is no longer regarded as the formidable operation which it was at one time assumed to be and must be looked upon as one of the most important aids to delivery in certain cases of labor. The improvements in the operative technique which have been developed within comparatively recent years permit the surgeon to execute it with practically the same degree of assurance and confidence that would accompany the performance of a laparotomy for any other abdominal condition.

The paper herewith presented includes a study of 104 consecutive Cæsarean operations performed by the writer between January 22, 1901, and July 28, 1911, in the service of the Lying-In Hospital of New York.

It is scarcely necessary or appropriate in this connection to review the history of this operation. The antiquity of the procedure in some crude form or other is assured, but the operation in the modern sense may be stated to have been developed since Sanger's first publication of his procedure. Prior to this time the collected statistics of the Cæsarean operation show a very high mortality and in the light of our present knowledge we must wonder less at this than at the fact that any of the mothers recovered from the operation. In reviewing the history of the operation there are several factors which stand out in bold relief as indicating the stages of progress in the development of the procedure. These include the careful suturing of the wound in the uterus, the performance of the operation under anæsthesia, the application of antiseptic and later aseptic methods, the Sanger technique, and the use of absorbable suturing material. The operation devised by Sanger must be regarded as marking a point in the history of the Cæsarean section where an abrupt turn towards rapid upward progress began. Although Sanger's technique, as published in the early eighties, was far in advance of any previously employed procedure, it is quite generally regarded at the present time as crude, productive of unnecessary shock, and more or less unsatisfactory in its after results. Sanger's procedure may be briefly described as follows: After cleansing the abdomen and vagina with an antiseptic solution, a long median incision is made extending from a point a short distance below the umbilicus down to the symphysis pubis. Two long sutures are inserted at the upper angle of this wound and the pregnant uterus is delivered through the opening, after which the sutures noted are drawn together and tied so as to close off the upper part of the abdominal opening and hold back the intestines. The lower portion of the uterus is then surrounded with rubber dam so as to further protect the peritoneal cavity from blood, liquor amnii, and meconium. An Esmarch's rubber band encircles the lower uterine segment and is drawn tight by an assistant in order to control the hæmorrhage. The uterus is finally opened in the median line from a point just below the fundus down to the cervix, followed by the delivery of the child, placenta, and membranes. The edges of the uterine wound are then trimmed and sutured in three layers, one deep and one superficial layer of interrupted sutures buried by a final layer of Lembert sutures, after which the uterus is returned to the abdominal cavity and the wound in the abdominal wall closed.

The extensive character of this operation and the degree of shock produced compares very unfavorably with the comparative rapidity and lesser degree of shock of the more modern procedures. In summarizing the indications for the Cæsarean operation one of the principal aims should be to secure the delivery of a full-term, healthy child without having subjected the same to prolonged uterine compression against pelvic obstruction, to

subject the mother to the minimum of shock due to exposure and handling of the abdominal contents, to avoid undue hæmorrhage, to plan the necessary operative wounds so that subsequent adhesions will be avoided, to avoid interfering with the proper involution of the uterus, to prevent postoperative hernia, and finally to make the puerperal period as free from complications and as short as possible. The procedure which was devised by Sanger fails in many respects in meeting these requirements.

It was my good fortune to take part in some of the first Cæsarean operations performed in the service of the Lying-In Hospital which were done almost twenty years ago. Eight of these operations were done in tenements, three by the writer himself, who is, therefore, able to refer to his personal experience with the other type of operation herewith noted. In all these cases the usual long incision in the lower part of the abdomen was employed which permitted the escape of, and necessitated undue handling of the abdominal contents. The abdominal cavity and its viscera may be exposed and examined with great freedom if necessary but it must be acknowledged that if this can be avoided it results in a decided gain for the patient. Moreover when an abdominal wound of this size and in this position is closed by suture, a large portion of it necessarily remains in contact with the wound in the uterus. In several cases it was found that firm union had taken place between the uterus and the abdominal wall as a result of this approximation and the uterus became fixed above its former level with consequent dragging pains and other symptoms. Herniæ have also been observed in a number of cases along the line of the scar in this position. The delivery of the pregnant uterus from the abdominal cavity produces well-marked shock which is likewise furthered by the unavoidable handling of the intestines, by the abrupt change of intra-abdominal pressure and the extensive exposure of peritoneal surface to a temperature decidedly lower than that of the interior of the body. The Esmarch rubber band which was used in the earlier cases was soon discarded as unnecessary and as increasing the chances of septic infection. If carelessly or forcibly applied it might also do considerable injury by contusion of the tissues included in its grasp.

Governed by the experience gained as assistant and that based on three personal cases, the writer did his fourth Cæsarean operation on August 12, 1903, in which the abdominal incision was modified as follows: It was made in the median line about 10 cm. long and extended partly above and partly below the umbilicus, being carried around the left side of the latter. This was the first case in his series in which the uterus was not delivered through the abdominal incision and in none of the subsequent cases was this delivery of the pregnant uterus resorted to.

In succeeding operations the abdominal incision was carried gradually upward until in the twelfth case of the series, done November 20, 1904, the writer, so far as he is aware, was the first to make the incision for this operation entirely above the umbilicus. In this patient a previous Cæsarean operation had already been done by the writer with an incision through the abdominal wall at a point further down. With few exceptions the high median incision has been used consistently in the remainder of the cases in the series herewith reported and in no instance was the uterus delivered from the abdominal cavity before extracting the child. An exception to this method involved a case in which rupture of a tonically contracted uterus while containing the second of twins was thought to have occurred and in which a hysterectomy might have been found necessary.

The total number of women delivered in the combined indoor and outdoor services of the Lying-In Hospital from January 18, 1890, to July 28, 1911, totals 72,832. In this number, Cæsarean section was performed 298 times, or once in 244.40 cases. Of these mothers 264 recovered and 34 died. Of the total number of children delivered by Cæsarean section 26 died and 19 were stillborn. The writer has performed up to July 28, 1911, 104 Cæsarean operations, of which the details are noted in the accompanying table. These 104 operations were done on 89 women of whom fifteen died, a maternal mortality of

Case No.	Conf. No.	Date of Admission.	Date of confinement.	Diagnosis	Indication	Result Child	Day of discharge	Remarks	Para
1	21,259	Nov. 19, 1900	Jan. 23, 1901	Vertex L. O. A.	Rachitic dwarf	Lived	36th		I
2	22,752	Aug. 18, 1901	Aug. 18, 1901	Vertex L. O. A.	Flattened generally contr. pelvis. Bicorn. uterus	Stillbirth	43d		I
3	23,369	Aug. 10, 1901	Nov. 6, 1901	Vertex	Generally contr. Prolonged labor (midwife)	Died 3d day	22 hrs, Died	Sepsis; suppression of urine	I
4	2,973	July 20, 1903	Aug. 12, 1903	Vertex L. O. A.	Rachitic pelvis	Lived	38th	First case in which uterus was not delivered	I
5	3,093	Sept. 15, 1903	Sept. 22, 1903	Vertex L. O. A.	Funnel pelvis	Lived	34th		III
6	3,168	Sept. 17, 1903	Oct. 13, 1903	Vertex L. O. A.	Ankylosis right hip, Naegele pelvis	Lived	58th		I
7	3,228	Oct. 24, 1903	Nov. 23, 1903			Not viable	30th	General sarcomatosis; pregnant 7th mo. Sarcoma of pelvic and abd. organs; anasarca. Died at home, 76th day	I
8	3,383	Nov. 21, 1903	Dec. 18, 1903	Vertex L. O. A.	Rachitic dwarf. Marked lordosis	Lived	52d		I
9	3,684	Feb. 26, 1904	Feb. 26, 1904	Vertex R. O. A.	Rachitic, oblique	Lived	26th		I
10	3,766	Mar. 18, 1904	Mar. 18, 1904	Vertex R. O. A.	Generally contracted pelvis	Lived	19th	Sepsis; prolonged labor; attempted delivery before admission. Second Cæsarean section	I
11	3,857	Apr. 11, 1904	Apr. 11, 1904	Vertex	Rachitic pelvis	Lived	30th		II
12	4,830	Oct. 19, 1904	Nov. 20, 1904	Vertex L. O. A.	Rachitic pelvis. Same as No. 4 (2973)	Lived	29th	First case with median incision wholly above umbilicus	III
13	4,867	Nov. 20, 1904	Nov. 29, 1904	Vertex R. O. A.	Naegele pelvis; right side	Lived	19th	Scar 7 cm. long. Sitting up on 14th day	I
14	5,079	Jan. 17, 1905	Jan. 17, 1905	Vertex L. O. A.	Flat pelvis. Long labor. Forceps attempted by outside doctors	Died in 53 hrs.	3d. Died	General peritonitis; gangr. endometritis; general streptococcemia and staphylococcemia	I
15	5,249	Feb. 20, 1905	Feb. 20, 1905	Vertex L. O. A.		Marasmus, died 25th day	1st day		I
16	5,747	May 27, 1905	June 7, 1905	Breech L. S. A.	Double promontory. Rachitic pelvis	Lived		Before this other operators did craniotomy and two Cæsareans	IV
17	5,880	July 23, 1905	July 23, 1905	Vertex	Carcinoma cervix and vagina	Lived	29th		II
18	5,220	July 8, 1905	Sept. 11, 1905	Vertex L. O. A.	Flat pelvis	Lived	29th		I
19	6,449	Sept. 28, 1905	Oct. 18, 1905	Vertex R. O. A.	Generally contracted	Lived	18th	C. S. 6-21-'04. Other operator	II
20	7,194	Mar. 11, 1906	Mar. 12, 1906	Vertex L. O. A.	Flat, figure 8 pelvis	Lived	16th		I
21	7,276	Mar. 27, 1906	Mar. 27, 1906	Face R. M. P.	Obliquely contracted pelvis. Impacted face. Tonic uterine contractions	Marasmus, died 28th day	36th	Cephalic and podalic versions failed	I
22	7,391	Apr. 13, 1906	Apr. 14, 1906	Vertex L. O. A.	Rachitic dwarf	Lived	25th		I
23	7,398	Apr. 16, 1906	Apr. 16, 1906	Vertex L. O. A.	Contracted pelvis	Lived	23d	C. S. 10-27-'04. Other operator	IV
24	7,545	May 10, 1906	May 10, 1906	Vertex L. O. A.	Flat pelvis	Lived	38th		I
25	8,727	Nov. 25, 1906	Nov. 25, 1906	Vertex R. O.	Transverse generally contr. pelvis	Lived	15th		II
26	8,931	Dec. 25, 1906	Dec. 25, 1906	Vertex L. O. A.	First child delivered in OPD 38124. Tonic uterine contractions	Died	31st	Version and high forceps attempted. Admitted as ruptured uterus	IV
27	8,918	Dec. 23, 1906	Dec. 23, 1906	Vertex L. O. A.	Flat, generally contracted	Lived	18th		II
28	9,189	Feb. 1, 1907	Feb. 1, 1907	Vertex R. O. P.	High forceps attempted; private doctor. Flat pelvis, long labor	Died 10th day	Died 2d	General streptococcemia both in mother and child	I

29	10,100	Apr. 29, 1907	June 16, 1907	Vertex L. O. A.	Second Cæsarean. Same as No. 65. Rachitic pelvis	Lived	22d		I
30	10,128	May 12, 1907	June 19, 1907	Breech L. S. A.	Rachitic pelvis. Long spines	Lived	18th	First Cæsarean, No. 11 (3857)	IV
31	10,487	Aug. 4, 1907	Aug. 5, 1907	Vertex L. O. A.	Flat justo-minor	Lived	34th		II
32	10,499	Aug. 6, 1907	Aug. 6, 1907	Vertex R. O. A.	Flat justo-minor	Lived	20th		I
33	10,792	Sept. 10, 1907	Sept. 10, 1907	Vertex L. O. A.	Flat rachitic pelvis	Lived	17th	First Cæsarean. Same as No. 24 (7545)	II
34	10,968	July 19, 1907	Oct. 7, 1907	Vertex R. O. A.	Rachitic dwarf	Stillbirth	27th	Cord prolapsed while taking ether for Cæs.	I
35	11,000	Oct. 13, 1907	Oct. 13, 1907	Vertex R. O. A.	Double promontory. Laterally contracted pelvis	Lived	15th		III
36	11,157	Nov. 7, 1907	Nov. 8, 1907	Vertex R. O. A.	Flat pelvis	Lived	29th		II
37	11,169	Nov. 10, 1907	Nov. 10, 1907	Vertex L. O. A.	Eclampsia, 9½ mos.	Lived	17th	Not in labor	I
38	11,258	Nov. 22, 1907	Nov. 23, 1907	Vertex	Generally contracted pelvis	Lived	16th	First child died 6th day p. p. High forceps	II
39	11,481	Dec. 25, 1907	Dec. 26, 1907	Vertex L. O. A.	Generally contracted pelvis	Lived	2d, died	Shock, hæmorrhage. 3d Cæsarean section	III
40	11,607	Jan. 9, 1908	Jan. 9, 1908	Vertex	Ruptured uterus. Same as No. 27 (918) 2d C.S.	Lived	20th	Delayed reporting until long in labor	III
41	11,823	Feb. 5, 1908	Feb. 5, 1908	Vertex	Impacted in pelvis. Fibroids of uterus	Lived	19th	Resection of tubes	IV
42	11,006	Feb. 15, 1908	Feb. 16, 1908	Breech	Fourth Cæsarean	Lived	20th	Same as No. 16 (5747)	VI
43	12,148	Mar. 17, 1908	Mar. 17, 1908	Vertex	Not in labor. Eclampsia. Full term. Justo-minor	Lived	61st	Homeless	I
44	12,243	Mar. 27, 1908	Mar. 27, 1908	Vertex	Lobar pneumonia. Moribund	Died 5th	Died	Died 14 hrs. after operation	VI
45	12,249	Mar. 31, 1908	Mar. 31, 1908	Breech L. S. A.	Acute dilatation of stomach. Naegele pelvis	Lived	Died	Anæsthesia taken badly. Died 30 mins. after operation	II
46	12,453	Apr. 29, 1908	Apr. 29, 1908	Vertex L. O. A.	Flat pelvis	Lived	Died	Died 54th day; septic endometritis	II
47	12,482	May 1, 1908	May 2, 1908	Breech	Generally contracted	Lived	14th		I
48	12,483	Apr. 21, 1908	May 2, 1908	Twins, both vertex	Eclampsia, 9½ mos. Toxæmia	Both lived	Died	Died on table. Not in labor	I
49	12,531	May 8, 1908	May 8, 1908	Vertex L. O. A.	Justo-minor flat	Lived	26th	Inspiration pneumonia	I
50	12,583	May 15, 1908	May 15, 1908	Face R. M. A.	Flat pelvis	Lived	16th		I
51	12,661	May 27, 1908	May 28, 1908	Breech L. S. A.	2½ mos. A. P. Eclampsia	Lived	31st		I
52	12,038	June 28, 1908	June 28, 1908	Vertex L. O.	Transverse, flat, generally contracted	Lived	13th		IV
53	14,178	Dec. 9, 1908	Dec. 9, 1908	Vertex L. O. A.	Transverse, flat, generally contr. attempted high forceps	Lived	24th		VIII
54	14,565	Jan. 29, 1909	Jan. 30, 1909	Vertex L. O. A.	Justo-minor pelvis	Lived	15th, died	Returned to Hosp. 29th day, mural abscess died 30th day	III
55	14,637	Feb. 10, 1909	Feb. 10, 1909	Vertex R. O. A.	Tumor, probably dermoid	Lived	14th		VIII
56	14,731	Feb. 11, 1909	Feb. 20, 1909	Vertex L. O. A.	Flat rachitic pelvis	Lived	14th		I
57	15,479	May 19, 1909	June 6, 1909	Vertex	Neoplasm of cervix	Died 4th day	16th	Hemophilia neonatorum	III
58	15,575	June 12, 1909	June 19, 1909	Vertex R. O. A.	Flat pelvis. Ventral fixation	Lived	20th		V
59	16,500	Oct. 31, 1909	Oct. 31, 1909	Vertex L. O. A.	Fifth Cæsarean	Lived	16th	Same as No. 16 (5747)	VII
60	16,558	Nov. 4, 1909	Nov. 12, 1909	Vertex R. O. A.	Flat pelvis. Placenta prævia marginata	Lived	43d	Not in labor; persistent bleeding	I
61	16,890	Jan. 4, 1910	Jan. 4, 1910	Vertex L. O. A.	Generally contracted	Lived	12th		I

Case No.	Conf. No.	Date of Admission.	Date of confinement.	Diagnosis	Indication	Result Child	Day of discharge	Remarks	Para
62	16,961	Jan. 12, 1910	Jan. 15, 1910	Vertex R. O. A.	Exostosis back of symphysis	Lived	12th		I
63	16,977	Jan. 17, 1910	Jan. 17, 1910	Vertex L. O. A.	Laterally contracted pelvis	Ch. died 54th day, Atelectasis	59th	Operation 25th day to cure old umbilical hernia	III
64	17,107	Feb. 4, 1910	Feb. 5, 1910	Vertex L. O. A.	Not in labor. Eclampsia. 8½ months	Died 23d	Died 2d		I
65	17,113	Feb. 6, 1910	Feb. 6, 1910	Vertex L. O. A.	Rachitic pelvis	Lived	12th	Second Cæsarean. Same as No. 29 (10100)	II
66	17,128	Nov. 6, 1909	Feb. 10, 1910	Vertex L. O. A.	In labor 48 hrs. Small rachitic pelvis	Lived	25th	Becoming exhausted p. 120	I
67	17,214	Feb. 19, 1910	Feb. 23, 1910	Vertex R. O. A.	9th mo. Not in labor. Justo-minor pelvis	Died	Died 7 hrs. 18th	Streptococcemia; cerebro spinal meningitis	I
68	17,310	Feb. 26, 1910	Mar. 10, 1910	Vertex R. O. A.	Rachitic dwarf. 2d C. S.	Lived	12th	Same as No. 22 (7391)	II
69	17,493	Mar. 31, 1910	Apr. 5, 1910	Vertex R. O. A.	Rachitic contracted pelvis	Lived	12th	First child craniotomy	II
70	17,514	Apr. 9, 1910	Apr. 9, 1910	Vertex L. O. A.	Rigid cervix. Living child. Not in labor. Eclampsia	Lived	24th		II
71	17,562	Apr. 18, 1910	Apr. 18, 1910	Vertex R. O. A.	Flat pelvis. Second C. S.	Lived	12th	Same as No. 35 (11000)	II
72	17,603	Apr. 26, 1910	Apr. 26, 1910	Both vertex; twins	Eclampsia. No sign of fœtal life. Twins	Stillbirths	19th		I
73	17,702	May 16, 1910	May 16, 1910	Vertex L. O. A.	Contracted pelvis	Lived	11th		II
74	17,780	June 1, 1910	June 1, 1910	Vertex R. O. A.	Contracted inlet. Exostosis. Same as No. 50 (12583)	Lived	17th	Rupture of uterus through old Cæsarean scar. 2d Cæsarean section	VIII
75	17,856	June 20, 1910	June 20, 1910	Vertex R. O. A.	Rachitic dwarf	Lived	13th		II
76	17,938	July 6, 1910	July 11, 1910	Breech	Rachitic dwarf. 2d C. S. Same as No. 31 (10487)	Lived	15th		III
77	18,101	Aug. 17, 1910	Aug. 18, 1910	Vertex L. O. A.	Long labor, 90 hrs. Rachitic flat pelvis	Lived	6th	Midwife. Septicemia. Streptococcemia	I
78	18,103	Aug. 18, 1910	Aug. 18, 1910	Vertex R. O. A.	Contracted pelvis. Atresia of vagina	Died 2d day	12th	Hydramnios. In labor 10 hrs. Ch. premature	I
79	18,466	Oct. 21, 1910	Oct. 22, 1910	Vertex L. O. A.	Irregularly contracted pelvis	Lived	14th		V
80	18,992	Jan. 28, 1911	Jan. 28, 1911	Vertex R. O. A.	Flat rachitic pelvis	Lived	11th	3d Cæsarean; one ectopic	IV
81	19,001	Jan. 30, 1911	Jan. 30, 1911	Vertex R. O. P.	Gen. contracted pelvis; long labor	Lived	14th		I
82	19,029	Feb. 3, 1911	Feb. 3, 1911	Vertex L. O. A.	Eclampsia 7th month. Not in labor	Lived	27th		I
83	19,148	Feb. 21, 1911	Feb. 28, 1911	Vertex R. O. P.	Funnel pelvis. Slow labor	Stillbirth	15th	On post. wall of uterus, broad contr. band	I
84	19,205	Mar. 5, 1911	Mar. 5, 1911	Vertex R. O. A.	Eclampsia. 8th mo. Not in labor	Lived	17th		I
85	19,208	Feb. 8, 1911	Mar. 5, 1911	Vertex L. O. A.	Funnel, generally contracted pelvis	Lived	17th		I
86	19,223	Mar. 8, 1911	Mar. 8, 1911	Vertex L. O. A.	Eclampsia. 8th month. Not in labor	Lived	12th		I
87	19,225	Mar. 8, 1911	Mar. 8, 1911	Vertex R. O. P.	Funnel pelvis. Long labor	Lived	12th		I
88	19,276	Mar. 17, 1911	Mar. 17, 1911	Vertex L. O. A.	Contracted pelvis. Large child	Lived	12th		V
89	19,307	Mar. 21, 1911	Mar. 21, 1911	Vertex L. O. A.	Laterally contracted pelvis	Lived	10th		I
90	19,321	Mar. 24, 1911	Mar. 24, 1911	Vertex R. O. P.	Tumor, dermoid (?) post. part of pelvis	Lived	16th	2d C. S. Same as No. (14637)	IX
91	19,353	Mar. 30, 1911	Mar. 30, 1911	Vertex L. O. A.	Generally contracted pelvis	Lived	10th		I
92	19,367	Mar. 31, 1911	Mar. 31, 1911	Vertex L. O. A.	Eclampsia. 8th month. Not in labor	Lived	Died 1st	Suppression of urine; repeated convulsions	I

93	19,582	May 4, 1911	May 4, 1911	Vertex L. O. A.	Funnel pelvis	Lived	12th	2 stillbirths; one child lived 24 hours	IV
94	19,586	May 5, 1911	May 5, 1911	Vertex	Generally contracted pelvis	Lived	14th	Second Cæsarean. Same as No. 61	II
95	19,617	May 7, 1911	May 8, 1911	Vertex L. O. A.	Rachitic pelvis; narrow outlet	Lived	12th		I
96	19,823	June 2, 1911	June 3, 1911	Vertex R. O. A.	Generally contracted pelvis	Lived	13th		II
97	19,898	June 14, 1911	June 14, 1911	Vertex R. O. T.	Funnel pelvis; double promontory	Lived	11th		I
98	19,900	June 16, 1911	June 17, 1911	Vertex R. O. A.	Funnel pelvis; double promontory	Lived	12th		III
99	19,951	June 4, 1911	June 23, 1911	Vertex L. O. A.	Rachitic pelvis	Lived	11th	Third Cæsarean. Same as Nos. 29 and 65	III
100	20,028	July 4, 1911	July 4, 1911	Breech L. S. A.	Placenta prævia, central	Stillbirth	Died 17th day	General sepsis; staphylococcus aureus	I
101	20,083	July 10, 1911	July 10, 1911	Vertex L. O. T.	Justo-minor pelvis; extended vertex	Lived	12th		I
102	20,136	June 14, 1911	July 21, 1911	Vertex L. O. A.	Oblique pelvis; narrow inlet	Lived	16th	Abortion at fourth month; second labor, twins, one lived; third labor, high forceps, child lived 24 hours	IV
103	20,180	June 1, 1911	July 26, 1911	Vertex L. O. A.	Naegele pelvis	Lived	17th	Remained longer because of operation upon child	I
104	20,200	July 28, 1911	July 28, 1911	Vertex L. O. A.	Flat. Generally contracted pelvis	Lived		Second Cæsarean section. First in another hospital	II

16.83 per cent. If the mortality is based on the number of operations it is 14.43 per cent. In this series of cases twins were delivered twice making a total of 106 in the number of children. Of this number seven (6.6 per cent) were stillborn, and twelve (11.11 per cent) subsequently died in the hospital. The presentations were as follows: 96 vertex, 8 breech, and 2 face. The infant mortality in our series was 17.92 per cent (including stillbirths), and this may with advantage be studied more in detail. The numbers attached to each case correspond to those of the appended table. Stillbirths resulted in six cases, one of which was a twin pregnancy, making a total of seven children.

No. 2. Labor prolonged with midwife in charge. Repeated attempts by outside physicians at delivery with high forceps. The mother made a complete recovery notwithstanding the prolonged administration of chloroform before operation. Although the fœtal heart beat for some time after delivery respiration could not be induced.

No. 7. In this case the mother's pelvis was blocked by a large sarcoma and the operation was necessary to relieve the great abdominal distension and to terminate the pregnancy. The child was seven months and not viable.

No. 34. In this case the cord prolapsed, following a sudden rupture of the membranes while the patient was taking ether preparatory to Cæsarean section. The cord was subjected to considerable compression and there was no sign of life in the child upon delivery. The mother was a rachitic dwarf and recovered.

No. 72. This patient was brought in on the ambulance with a history of repeated violent eclamptic convulsions at short intervals. The patient was at term in a constant state of coma and not in labor. Although no signs of fœtal life could be elicited it was thought that Cæsarean section offered the best chances for the mother. Twins were delivered stillborn, but the mother made a complete recovery.

No. 82. In this patient the pelvis was funnel-shaped and she had been long in labor. The membranes were ruptured for some time previously, the pains were weak and the cervix only slightly over two fingers dilated. As there were no tonic uterine contractions ap-

parent it was thought safe to postpone the Cæsarean section for a period of two hours. The fœtal heart could be heard until just before operation but a dead child was delivered. The mother made a good recovery.

No. 100. This patient was at term, but not in labor and had been bleeding from a central placenta prævia, which had been treated with gauze packing by an outside physician. The mother was greatly affected by the intense heat and the child was probably dead upon admission. The operation was undertaken on account of the central implantation of the placenta, but the previous hæmorrhage had probably resulted in the asphyxia of the child. This mother also died on the seventeenth day from sepsis (staphylococcus aureus).

Twelve children died in the hospital subsequent to delivery.

No. 3. Died on the third day. Labor had been a very long one. Midwife in charge. Mother intensely septic, died in twenty-two hours, sepsis, prolonged labor, and suppression of urine. Operation in tenement, child much neglected.

No. 14. Child died fifty-three hours after delivery. Long labor, attempted high forceps by private physicians. Severe forceps wounds on child's head. Mother died on third day from general streptococcemia.

No. 15. Died on the twenty-fifth day. Marasmic, always a feeble child. Mother poorly nourished, survived.

No. 21. Died twenty-eighth day. Marasmic. Impacted face, persistent chin posterior, tonic uterine contraction. Head much molded and extension of head increased markedly each day. The mother recovered.

No. 26. Died tenth day. Second twin. First delivered in the outdoor department per vaginam by version, forcible tonic contractions followed. Uterus thought to have been ruptured. Brought to hospital. Cæsarean section. No rupture of uterus. Child had depressed fracture of skull from pressure against promontory. Mother recovered.

No. 28. Died tenth day. General streptococcemia. Multiple small abscesses. High forceps attempted by private physicians. Mother died on second day. General streptococcemia.

No. 44. Died fifth day. Mother had lobar pneumonia, great dyspnœa, unable to lie down. Moribund. Operation to relieve dyspnœa and possibly save an eight months' child. Mother improved for twelve hours, grew worse, died at end of fourteen hours.

No. 57. Died fourth day. Hemophilia neonatorum. Mother recovered.

No. 63. Died fifty-fourth day. Atelectasis. Always in poor condition and unable to nurse, fed with dropper. Had well marked hemophilia. Cured of this by injection of human blood serum. Mother recovered.

No. 64. Died twenty-third day. Premature, eight and one-half months. Mother died second day. Eclampsia.

No. 67. Died eighteenth day. Premature, eight months. Mother moribund. Died in seven hours. General streptoccocemia from an alveolar abscess, streptococcic cerebrospinal meningitis, operation to save child.

No. 78. Died second day. Slightly premature, poorly developed. Mother had atresia vaginæ, fairly marked hydramnios. Mother recovered.

As the maternal mortality of 14.43 in a consecutive series of 104 operations must be acknowledged as apparently quite high, a more detailed study of the fatal cases may with advantage be made at this point to determine whether such mortality should be charged exclusively to the Cæsarean operation. Sixteen children (one a twin birth) were delivered in the fifteen cases where the mother died, of which number seven were stillbirths or died subsequently. The remaining children, nine in number, left the hospital in good condition. The principal clinical features of the maternal fatal cases are as follows:

No. 3. Generally contracted pelvis, midwife long in charge, patient in poor condition and already very septic. Never recovered from shock, suppression of urine. Died in twenty-two hours. Child died third day.

No. 10. Generally contracted pelvis. Long in labor. Attempted high forceps by private physician. Had had one Cæsarean section. Septic when admitted. Died fourth day, general sepsis. Child lived.

No. 14. Flat pelvis, long labor. Attempt-

ed high forceps by private physicians. Culture from cervix before delivery and from blood after delivery showed streptococci. Died third day. General peritonitis, gangrenous metritis. Child died in fifty-three hours. Severe forceps wound of head.

No. 28. Flat pelvis, long labor, attempted high forceps by private physicians. Condition upon admission good. Culture from cervix before delivery and from the blood from arm vein later showed streptococci. Died second day from general streptococcemia. Child weighed 5,600 grams at birth, died tenth day, from general streptococcemia proved by culture from multiple small abscesses.

No. 39. Generally contracted pelvis, very slight, poor muscular development. Third Cæsarean. Atony of uterus. Fairly profuse hæmorrhage at time of operation. Slight persistent bleeding after operation. Died second day from shock and hæmorrhage. Child lived. *Clean case, no outside interference.*

No. 44. Lobar pneumonia, not quite at term, not in labor, moribund. Great dyspnœa, sitting almost upright in bed using all accessory respiratory muscles, lifting heavy distended abdomen at each inspiration. Child alive. Chloroform and oxygen given. Cæsarean section done without changing patient's position in bed. Decided improvement for twelve hours, than gradual decline and death two hours after, failing heart, edema of lungs. Child died fifth day.

No. 45. Naegele pelvis, clean case, in labor. Anæsthetic taken badly throughout, changing from chloroform to ether and the reverse. After uterine wound was closed greatly distended stomach suddenly appeared at abdominal wound. Stomach washed out at once. Abdomen quickly closed and dressed. Condition improved. Taken to ward, became worse suddenly and died in thirty minutes after operation. Child lived.

No. 46. Flat pelvis. No outside manipulation, in labor, poor mentality and physique, filthy in appearance and habits. Septic endometritis and abscess in uterine wound with omental adhesions. Died thirty-fourth day. Child lived.

No. 48. Toxæmia of pregnancy, nearly at term. Not in labor. Under treatment in wards. Clean case. Convulsions. Preparation for Cæsarean began at once. Operation within forty-five minutes after first convulsion. Patient moribund before preparation began. Died on table, twins delivered, both lived.

No. 54. Justo-minor pelvis. Labor began in wards. No outside manipulation. Clean case. Second Cæsarean. No fever. Recovery uneventful. Profuse purulent flow of lochia on twelfth day. Culture from uterine cavity taken showed colon bacillus. Discharged with child from hospital sixteenth day with uterus moderately adherent, not sensitive, condition apparently good. Re-admitted very ill two weeks later. Fever, tenderness over uterus. Hysterectomy done on thirty-first day postpartum. Died ten days later.

No. 64. Brought to hospital in ambulance. Eight and one-half months' pregnant. Para I. Not in labor. Coma and repeated convulsions. Child alive. Died second day. Child died twenty-third day.

No. 67. Justo-minor pelvis. Para I. Not in labor. Ninth months' pregnancy. Blood from arm vein and spinal puncture showed many streptococci. Cerebrospinal meningitis (autopsy). Infection began in an alveolar abscess. Moribund. Operation entirely in interest of child. Child died eighteenth day.

No. 77. Para I. Ninety hours in labor. Attempted high forceps by outside physicians. Child alive. Apparent condition of patient good. Rachitic, markedly flat pelvis. Staphylococcemia by culture from arm vein. Died sixth day. Child lived.

No. 92. Para I. In coma. Having convulsions. Eight months' pregnant. Not in labor. Child alive. Ambulance case. Catheterized upon admission. About 400 cc. of black urine withdrawn. Absolute suppression of urine thereafter. Operation at once upon admission. Died in twenty-three hours. Child lived.

No. 100. The mother was nine months' pregnant, not in labor and had developed a hæmorrhage from a central placenta prævia. Gauze packing had been introduced by a phy-

sician outside of the hospital. The mother was overcome by the intense heat and the child was probably dead upon admission. The operation proceeded without any difficulty and there was no other reason apparent for the death of the child. This mother also died of sepsis on the seventeenth day and the case will be referred to again later on.

A study of these fatal cases shows the following points of interest. It will be noted that five of these women had long been in labor and were subjected to more or less severe attempts at operative delivery before coming to the hospital (Nos. 3, 10, 14, 28, 77). All were septic, all were primiparæ except No. 10, in which the Cæsarean section had been done on a previous occasion. Two out of the five children delivered survived. There were three cases of eclampsia not in labor, Nos. 48, 64, and 92, of which two were emergency cases brought in by the ambulance and one developed in the wards. All three of these patients were in a desperate condition, one (No. 48) being moribund and dying on the table. Four children were delivered from these three eclamptic patients of which three, including a pair of twins, lived. In two cases, Nos. 44 and 67, the patients were dying, one as the result of pneumonia and the other with a meningitis. Neither of these women was at term or in labor and the Cæsarean operation cannot be blamed for their deaths. In the pneumonia case there was a decided temporary improvement. In both instances, however, the children subsequently died. In the five remaining cases where the mother died, it is difficult to account satisfactorily for the fatal result. This group includes cases Nos. 38, 45, 46, 54, 100. The first four of these women were wholly under the care of the hospital and were not subjected to the possibility of infection from outside sources by other examiners or by attempts at delivery. They were presumably clean cases. In case No. 100, where a central placenta prævia served as an indication for the operation, the patient had been packed by an outside physician and her resistance was greatly lowered by the insolation from which she suffered. In case No. 39 three Cæsarean sections had been done previously and there was complete atony of the uterus with severe resulting hæmorrhage and shock. No. 45 took the anæsthetic very poorly throughout the operation and developed very suddenly an acute dilatation of the stomach. Case No. 46 was an individual of low grade both physically and mentally and very filthy in her habits. This woman developed a slowly progressing septic endometritis with numerous adhesions between the omentum, the uterine wound, and the anterior abdominal wall, with the subsequent formation of an abscess at this point, and death from general sepsis occurred on the fifty-fourth day. In case No. 54 a second Cæsarean operation was followed by an uneventful recovery to the twelfth day, when the lochia became purulent and were found to contain colon bacilli. There had been no temperature above 100, and the patient, apparently well, was discharged on the fifteenth day after delivery. She was re-admitted about two weeks later with a local condition resembling that in case No. 46. A hysterectomy was done three days after admission, but death from general sepsis resulted forty-two days after delivery. In four of these cases the children survived and in the other there was a stillbirth.

The fatal cases in the above may be divided into three groups. The first includes those that were septic before coming to the hospital, five in number. The second includes five moribund cases which were not in labor. The third class includes the apparently clean cases, numbering five, which were with one exception wholly under the care of the hospital.

In the first group it is quite improbable that in three of the women any form of operation could have saved their lives and there is a bare chance that some form of vaginal delivery might have been successful in the other two. The children in all these cases survived. In the five moribund cases the Cæsarean operation in no way affected the final result. Three of these children lived. Among the clean or apparently clean cases wholly under the care of the hospital, an acute dilatation of the stomach developed in one case, an accident that might have occurred with any other form of operation or delivery and was entirely beyond our control. In the patient

where hæmorrhage and shock resulted from atony of the uterus a craniotomy or some form of vaginal delivery followed by packing might have saved the patient, but this cannot be regarded as certain. In the one case (No. 100) the patient's general condition probably contributed to the fatal result. In the other two remaining cases we acknowledge that we cannot explain with satisfaction the fatal issue.

Leaving out the ten cases, five of which were septic and five moribund, we are justified in stating that the maternal mortality in the 94 remaining cases was 5.32 per cent.

The record here quoted simply shows that the patients either died or recovered and gives very little idea of the details or complications associated with the puerperium. We may safely claim, however, that personal experience with this operation and improvements in the technique have done much to render the puerperium of these women more or less uneventful. The comparative smoothness of the recovery is well illustrated by a glance at the column marked "day of discharge" in the appended table, from which it is evident that the operation does not ordinarily prolong the stay of these patients in the hospital. The record of a single month will serve as a further example. During March, 1911, nine Cæsarean operations were done with one fatality. The latter occurred in a woman deeply comatose from eclampsia, the urine was practically suppressed, the convulsions were frequent and the usual treatment was without response. Death resulted in twenty-three hours after admission and although an autopsy was not permitted it is probable that the case was one of a severe hæmorrhagic type of the disease. All the children from these nine cases survived. Two of the mothers were discharged on the tenth day, three on the twelfth, one on the sixteenth, and two on the seventeenth. The last three remained in the hospital longer than the others simply for their own convenience. Out of these nine cases there were three women with eclampsia, not at term. In three deformed pelves were present. In one there was a tumor of the lower abdomen and pelvis, probably a dermoid cyst. In one case with a laterally contracted pelvis the high forceps operation was attempted but failed. A subsequent Cæsarean section was followed by an uneventful recovery of both mother and child; who were discharged in good condition on the tenth day, with the uterus free from adhesions and not differing in size, mobility, or position from that of a woman delivered by normal labor.

In this list of 104 consecutive sections the total number is equally divided between primiparæ and multiparæ. Pelvic contractions in some form or other made the operation necessary in eighty-five cases. Eclampsia served as an indication in eleven cases of which eight mothers recovered and ten living children were born, there being two cases of twins of which one pair survived. In another case of eclampsia the premature child died on the twenty-third day.

Obstructing tumor growths made the operation necessary in six cases.

No. 7 was a multiple sarcoma; No. 17, carcinoma of cervix and vagina; No. 41, fibroid of the uterus; Nos. 49 and 90 (same patient), dermoid cyst of the ovary; No. 57, a neoplasm of the cervix which disappeared after delivery and the character of which was not determined.

Placenta prævia was present in two cases, Nos. 60 and 100.

The operation was done more than once in seventeen cases of the series.

In the following thirteen cases the operation was done twice.

No. 10. 3767, second Cæsarean section. First by another operator in another hospital. Second by the author.

No. 12. 4830, second Cæsarean section. First and second by the author. Same as No. 3093.

No. 23. 7398, second Cæsarean section. First by another operator, in this hospital. No. 4729.

No. 30. 10128, second Cæsarean section. First and second by the author. Same as No. 3857.

No. 33. 10792, second Cæsarean section. First and second by the author. Same as No. 7545.

No. 40. 11607, second Cæsarean section. First and second by the author. Same as No. 8918.

No. 54. 14565, second Cæsarean section. First by another operator in this hospital. Second by the author.

No. 66. 17310, second Cæsarean section. First and second by the author. Same as No. 7391.

No. 74. 17780, second Cæsarean section. First and second by the author. Same as No. 12583.

No. 76. 17938, second Cæsarean section. First and second by the author. Same as No. 10487.

No. 89. 19321, second Cæsarean section. First and second by the author. Same as No. 14637. Probable dermoid.

No. 94. 19586, second Cæsarean section. Same as No. 61.

No. 104. 20200, second Cæsarean section. First in another hospital. Second by the author.

In the following three cases the operation was done three times:

No. 39. 11481, third Cæsarean section. The second and third by the author. Same as No. 6449. First by another operator in this hospital.

No. 80. 18992, third Cæsarean section. First, second, and third by the author. Same as No. 7545 and 10792. Between the second and third Cæsarean sections, ectopic and removal of left tube.

No. 99. 19951, third Cæsarean section. Same as Nos. 28 and 65.

In the following case the operation was done five times:

No. 59. 16500. Fifth Cæsarean section. Third, fourth, and fifth by the writer, Nos. 57, 47, and 11906. The first and second Cæsarean sections on this patient were also done in this hospital, but by other operators. The first child was delivered by the writer by craniotomy (C. N. 20137) and the woman states that she has also had one abortion induced.

In discussing the advisability of repeating Cæsarean section, the question is often proposed as to the advisability of deliberately rendering these women sterile by operative means. In reply we can only state our conviction that we do not consider that in the absence of other reasons we have a right to resort to this procedure, and, therefore, we do the Cæsarean operation repeatedly on the same woman, and feel justified by the good results obtained.

Regarding the possibility of rupture of the uterus in labors subsequent to a Cæsarean section, we may state that the accident is not an impossible one and must be regarded in the nature of a real and considerable danger. In the series of cases herewith reported rupture of the uterus has occurred twice. In case No. 40, second Cæsarean section, same as No. 27, labor had been continuous for about forty-eight hours before the patient applied at the hospital. The lower uterine segment was very thin and there was a ragged laceration about 5 cm. long in the lower portion of the anterior wall of the uterus to the left of the median line. A living child was secured by the performance of a second Cæsarean section, and in view of the possibility of a recurrence of the rupture, it was considered advisable to render this woman sterile by resecting a portion of each tube near its uterine end and covering the ostia with peritoneum. There was very little hæmorrhage in this case and no shock, and the woman made an uneventful recovery. The second case, No. 74, was also many hours in labor before coming to the hospital. A Cæsarean section had been done two years previously for contracted pelvis (same as No. 50). The woman's general condition was very good at the time of admission. Upon opening the abdomen the uterus was found free from adhesions but a thin, flat clot of blood was seen to cover the lower portion of the old cicatrix. By removing this clot a tab of placenta was found partially filling an opening in the lower portion of the former cicatrix in the uterus. The latter was readily opened with the fingers and through this medium the child was readily extracted. The uterus was closed in the usual way after freshening the edges of the wound, and the mother and child made uneventful recoveries.

Had these women been under observation during the last of pregnancy, and Cæsarean section done as soon as labor began, these accidents would not have occurred. But it is not practicable to keep trace of these patients. After they have left the hospital some of them drift away into other hands. In other cases we

have no intimation that they are pregnant until they apply at the hospital, as these two cases did, after they had been long in active labor.

This emphasizes the necessity of warning these women who have had one or more Cæsarean sections to place themselves under the care of an obstetrician early in the event of subsequent pregnancy.

Indications for the operation. There are a certain number of women in whom the disproportion between the size of the pelvic passage and the child which is to traverse it is so marked that it is easy to say, regardless of pelvic measurements and in some cases of history of former easy spontaneous deliveries, that Cæsarean section is the only thing to do. This will include all marked deformities of the pelvis caused by rickets, malecosteon, exostosis neoplasms of the pelvis, uterus and rectum, cicatrices of the cervix following an old laceration or amputation of the cervix, some cases where ventral fixation has been done, some cases of impacted breech or face, where infection has been avoided, some cases of tonically contracted uterus, and accidental hæmorrhage. A very large proportion of eclampsias are best delivered in this way and also much better results will be obtained for mother and child if more cases of well marked placenta prævia are delivered in well equipped hospitals by Cæsarean section. Indications caused by the child will include those children with large non-molding heads with thick cranial bones and small fontanelles, monsters and the like.

There is a class of cases in which the Cæsarean operation comes into competition with delivery by forceps, podalic version, accouchement force, pubiotomy, or some of the so-called Cæsarean sections with various prefixes, where it becomes a matter of judgment with the surgeon, which operation shall be done. He seldom regrets electing Cæsarean section. It has been our experience often to deplore having done some of the other operations. It is not easy to forget the dead or maimed children, some of the latter carrying their physical and mental deformities throughout their lives, or the mothers who are rendered permanent invalids because of shock and extensive lacerations, which are incapable of being entirely repaired, when we feel sure that a healthy, uninjured child could have been delivered and the mother restored shortly to good health in many cases had Cæsarean section been done. This will include those cases of pelvic deformity or disproportion between pelvic capacity and child of less degree, certain cases of placenta prævia, of tonic contraction of the uterus, some cases in which ventral fixation has been done, some eclamptic cases and also moribund women, where the operation is done wholly in the interest of the child, or else to give relief temporarily to the mother, and also some cases of accidental hæmorrhage.

Regarding the most favorable time in pregnancy in which to perform the operation it may be stated that in those cases which are under observation before labor, we believe it wiser to wait until labor has begun, thus making it positive that the fœtus is mature. Unless this is done there is some danger of delivering a premature child. One may be easily misled as to the menstrual history, and a deformed pelvis and spinal column may hold the uterus up in such position that it will appear larger and nearer full term than it really is. As soon as it is established that labor has begun, operate without delay, thus saving the woman from further labor pains and the child from compression. It is not necessary for labor to go on long enough to dilate the cervix and thus insure uterine drainage after delivery. The eclampsia cases heretofore reported, were not in labor, the majority not at term. Many were primiparæ with the cervix still long and rigid and the cervical canal so small that it would not begin to admit the examining finger. No form of dilatation either by vagina or from above through the uterus was done, and yet there was never any trouble about uterine drainage after delivery. But, in a large percentage of these cases the surgeon has no choice; the women come under his observation for the first time already in labor, or other conditions appear, such as eclampsia, accidental hæmorrhage, placenta prævia, etc., which make them emergencies demanding

immediate operation. If one has been able to follow the case from early pregnancy and thus can be sure of the maturity of the child there is no reason why a convenient time in the last week or two of pregnancy may not be elected for the operation.

The preparation of the patient should be conducted as for any laparotomy. Where there is time there should be a thorough clearing out of the intestinal tract. In all cases an enema should be given just before operation and no vaginal douche or other attempts at vaginal cleansing should be undertaken. The bladder must be catheterized.

It is our custom to have the abdomen and the external genitals shaved, washed with sterile water and green soap, cleaning well with gauze pads, as wash cloths. This is followed by swabbing with alcohol and ether. The whole area is then flushed with bichloride solution and then with warm sterile water. This is done after anæsthesia is well under way. The patient is covered with sterile drapings except at the site of the operation. She is in the horizontal position on the table throughout the operation. Shortly before starting the anæsthetic, xxv minims of ergot are injected deep into the muscles, (a valuable suggestion from Olshausen,) to guard against atony of the uterus and undue hæmorrhage.

The operation advocated is as follows: The abdomen is opened by a median incision 6 to 10 cm. long from above down to the umbilicus. One or two gauze pads wet in warm normal salt solution are placed above the fundus to hold back omentum and intestines. Often the uterus is found twisted upon its long axis, usually toward the right side. An assistant standing beside the patient opposite the operator makes pressure with his hands outside against the side walls of the abdomen, rotating the uterus so that its anterior wall looks directly forward and so regulating his pressure that the uterus is held well up to the abdominal opening until it is emptied of its contents — child, placenta, and membranes — and until several of the deep sutures are in place and tied. The uterus is then carefully opened with a scalpel so as to retain the membranes intact, by a median incision a little longer than the abdominal opening, in the mid-anterior surface of the uterus from just below the fundus downward. If the placenta presents in the wound it should be pushed aside or torn through and with the hand in the uterus, the membranes should be separated from the uterine wall. Neglect of this precaution often means that they must be removed piecemeal, sometimes with much difficulty and delay, after the child is delivered, and retraction and contraction have begun, and at a time when dangerous uterine hæmorrhage is most likely to occur. The anterior thigh of the child, or the one which is most readily found is grasped and delivered, and breech extraction is done, turning the child after delivery of the shoulders, so that it faces towards the mother's face. Then with the middle and index fingers of the right hand astride its neck and with the same fingers of the left hand in its mouth, making traction on its lower jaw, the head is carefully delivered so that there is no sudden jolting of the uterus in its delivery. An assistant stands ready with two long clamps in which he grasps the cord. It is cut between the clamps and the child is taken away to have respiration established, preferably into an adjoining room. At this stage, it was our custom formerly, to grasp the uterus with volsellum forceps at each angle of the wound. Twice we have grasped the intestines also in the upper forceps, once with slight puncture and leakage. There was no attempt to repair these punctures. The patients recovered, but it is considered a custom too dangerous to be continued. We now hook two fingers of the left hand into the uterus at the upper angle of the wound and with right hand clear the uterine cavity of placenta, membranes, and clots. A suture of No. 3 chromic gut is passed through the uterine muscle at each angle of the wound and tied. The first assistant now discontinues abdominal pressure and holds the uterus up in the abdominal opening by these sutures. We have not found a method of suturing the uterus which is wholly satisfactory to us. We close the uterus with eight to ten interrupted sutures of No. 3 chromic catgut passed just beneath the cut edge of the uterine peritoneum well out into the muscle and down to the endometrium and out on the opposite side in reverse order.

These sutures are readily buried by a continuous suture of No. 2 chromic gut, placed so as to pass through the peritoneum, well into the muscle and fold the peritoneum over the first layer of sutures. The abdominal pads are next removed. Very little attempt is made to cleanse the uterus or the abdominal cavity of clots. The abdominal wound is closed in three layers. The uterus takes its place in the lower part of the abdomen. A gauze dressing is held in place by adhesive bands drawn tight across the wound. Elsewhere the dressing is loose to allow the uterus free play in the lower abdomen and to avoid holding the abdominal wall tight against the uterine wound and thus reduce the liability to formation of adhesions. The head of the bed is elevated to allow descent of the uterus towards the pelvis and to favor drainage.

The after care in uncomplicated cases for the first forty-eight hours is that of any laparotomy and thereafter it is that of any postpartum case. The patient nurses her child. She is allowed out of bed on the eighth day and may go home on the twelfth day. A few have insisted upon being discharged from the hospital on the tenth and eleventh days.

Hæmorrhage is considered one of the great dangers of this operation. That from the abdominal wound may be discarded. There remain then only two other possible sites at which hæmorrhage can take place; the uterine wound and the placental site. While the uterus is being opened, an assistant can readily control any hæmorrhage from a large uterine sinus by holding a gauze pad over the bleeding point. This is seldom necessary. As soon as the hand is introduced to free the membranes from the uterine wall, the wrist exerts enough pressure at the wound to practically stop all hæmorrhage at that point, and as the child is withdrawn, its body and head continue to control the bleeding. If the placenta is located at the uterine opening this pressure acts as well upon that. If it is located elsewhere, it should not thus far have been disturbed. After the child is delivered by hooking the fingers into the uterus, as before mentioned, and pulling up on that organ the uterine sinuses will be seen to flatten and practically cease bleeding. The placenta is now detached. If there is much hæmorrhage, its site may be temporarily packed. The passage and tying of a few deep sutures,

added to the ergot, the influence of which should be active by this time, will usually induce enough uterine contraction so that hæmorrhage demands little further consideration. Repeatedly these operations are done without a clamp being used or a vessel ligated and there is sometimes even less loss of blood than in an ordinary delivery. Often there is almost no handling of the abdominal contents and only a small portion of omentum and the anterior wall of the uterus come into view.

In our experience, we believe it is decidedly important that the wound, while large enough for free delivery of the child, should be small and that it does make a difference where it is located, but it has been our experience and belief that its best location is in the mid-line above the umbilicus. To the trained surgeon this operation is easy of accomplishment. It is not a good operation for the novice in surgery.

Two photographs are herewith presented, the first, showing four patients twelve days after delivery by Cæsarean section. Two were operated upon March 5th, two March 8th. One in each of these groups was for eclampsia and one for funnel pelvis. The scar of the abdominal wound is plainly visible and the outline of the involuting uterus traced upon the abdominal wall is visible in each case. In one, the mid-pigmentation makes it appear as though the abdominal wound extended below the umbilicus. In the second picture these same women appear with their babies, and a fifth patient, who was operated upon March 17th, is seen in bed with her baby.

A CONSIDERATION OF THE ANATOMICAL RELATIONS OF THE GUT TUBE[1]

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THE development of the mature intestinal tract from the primitive gut-tube offers one of the most interesting anatomical instances of visceral rearrangement in the morphological development of the human organism. The prevailing views regarding the changes which the intestinal tube exhibits during its growth were very materially altered by the careful studies in reconstructions made by Mall. To him we owe much of our later and more accurate knowledge concerning the early relations of the primary U-shape loop of intestine, which finally by developmental changes results in the topographical relationships of the intestinal tube, as we ordinarily observe it at birth or shortly after. A knowledge of the changes in position, length, and diameter, incident to the development of the digestive tube, is imperative to properly appreciate any departures from the normal, whether they be regarded as defects in development, anomalies, or "disharmonies of nature."

The early fœtal arrangement of the six primary coils of the small intestine, and the position of the large bowel, are not of accidental or chance occurrence. They are the result of certain definite forces on the part of nature, which have for their specific purpose, the topographical establishment of the gut-tube as it is observed at birth. For instance, the position assumed by the duodenum is dependent upon two factors: (1) The degree of rotation of the stomach on its longitudinal axis, and its migration to a transverse position in the upper abdomen. (2) This portion of the small intestine is pushed into a retroperitoneal position, on the anterior surfaces of the lumbar vertebræ, owing to the early anterior and horizontal position which the transverse colon assumes in the upper abdomen.

These two factors largely determine the topography and shape of the duodenum. Imperfect drainage or partial occlusion of this part of the gut-tube, unless of pathological cause, is usually the result of anomalous development.

The ascending, transverse, and descending colon, owe their various relationships in the abdomen to the disproportionate development of the small intestine. The overgrowth of this segment of the gut-tube pushes the ascending and descending portions of the colon dorsolaterally, and causes the transverse colon to assume a ventro-superior position. Arrested development affecting any part of the large bowel or its mesentery is usually the underlying cause of anomalies in arrangement and position. The mere fact that the sigmoid colon at birth is nearly one-half of the entire length of the large bowel is explanatory of the amazing variations in length encountered in my own examinations of this particular segment of the bowel.

Continued study of variations affecting one or many parts of the large or small intestine is certainly convincing of the fact that many so-called postgenital anomalies are only exaggerated anatomical defects whose underlying causes are of developmental origin.

Stomach. Descensus of the stomach may be the result of one or two factors: If the force acting on this organ is not from below (colon, as is usually the case), the sagging is part of a vicious circle which includes a ligamentous elongation involving the attachments of the liver and spleen, and possibly the presence of mobile kidneys. The gastrohepatic omentum is never a robust structure, but usually is thin, devoid of fat, and transparent. The lateral borders are thicker than the median portion.

Owing to its anatomical structure, this

These observations were undertaken at the suggestion of Dr. John G. Clark, whose paper dealing with the clinical and surgical aspects of this subject appeared in the Journal of the American Medical Association.

The examinations were made in the Anatomical Department of the University of Pennsylvania, and the writer is deeply indebted to Drs. John G. Clark and George A. Piersol for their kindly suggestions and assistance.

[1] Read by invitation before the Philadelphia College of Physicians, February, 1911.

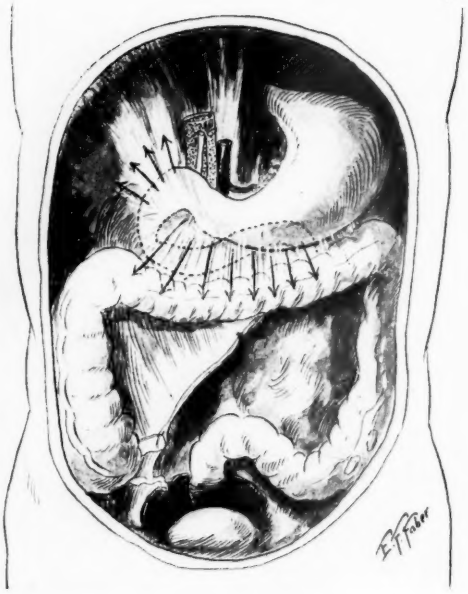

Fig. 1. Direction of forces acting on shape of duodenum. The cardiac and pyloric portions of the stomach represent fixed points.

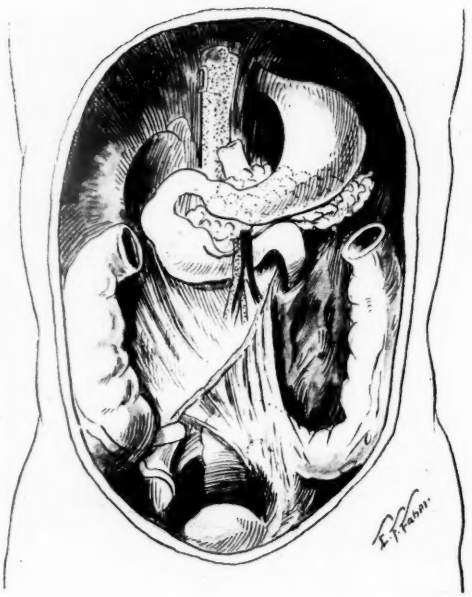

Fig. 2. Relation of superior mesenteric artery to ventral surface of duodenum. Sigmoid tied down by bands passing to under surface of mesentery.

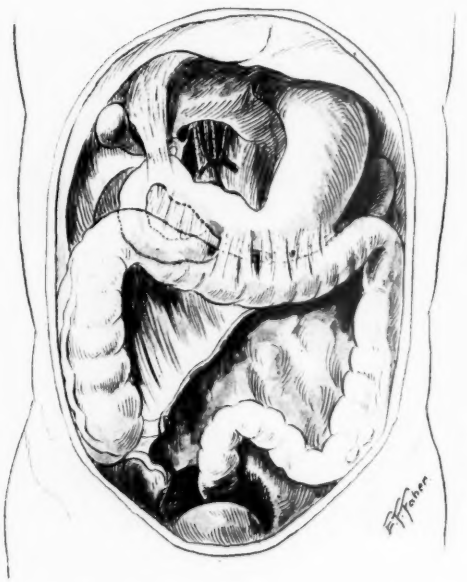

Fig. 3. Stomach fixed by esophagus and hepatico-duodenal ligament. Traction on greater gastric curvature by transverse colon, altering shape of stomach.

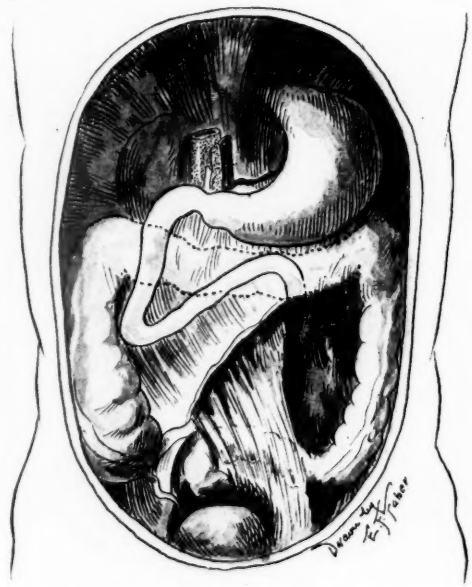

Fig. 4. V-shaped duodenum lying to right of vertebral column. Bands from under surface of mesentery to sigmoid colon.

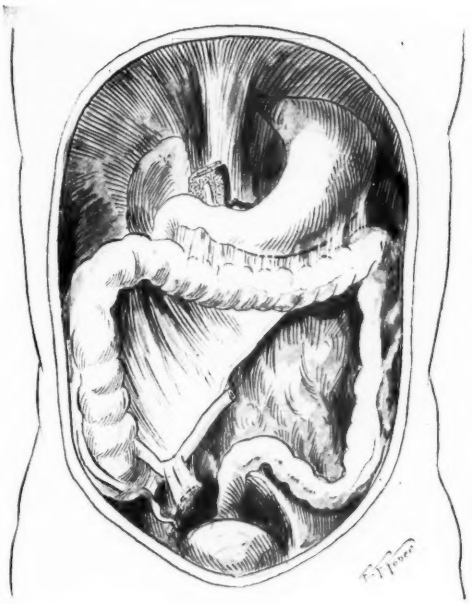

Fig. 5. "Lane's kink of ileum." Note mesenteric band angulating terminal ileum and fixing same to right sacro-iliac joint.

Fig. 6. Ileocecal opening on dorsal cecal aspect. Terminal ileum lying behind cecum.

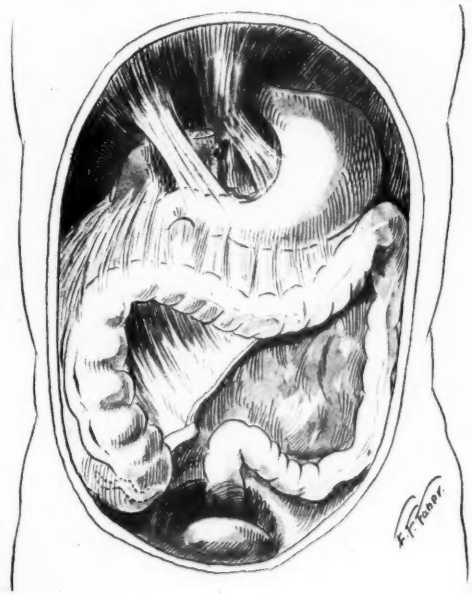

Fig. 7. Cecal ptosis dragging down hepatic flexure. Note the great dilatation of the ptosed cecum and ascending colon.

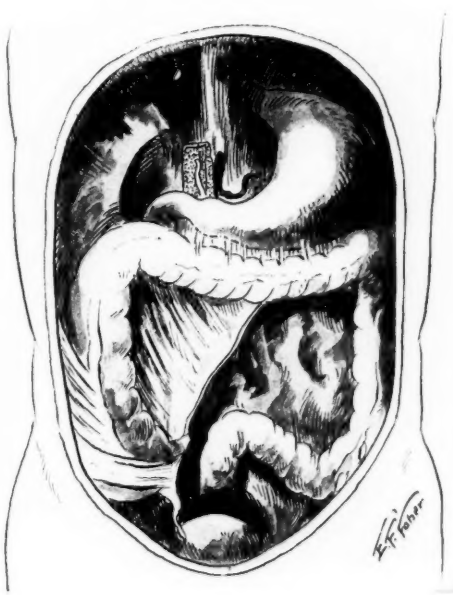

Fig. 8. Peritoneal bands passing to anterior surface of cecum and ascending colon. These are peritoneal folds due to cecal ptosis.

Fig. 9. Dilated cecum and ascending colon owing to narrowing of lumen of colon at splenic flexure.

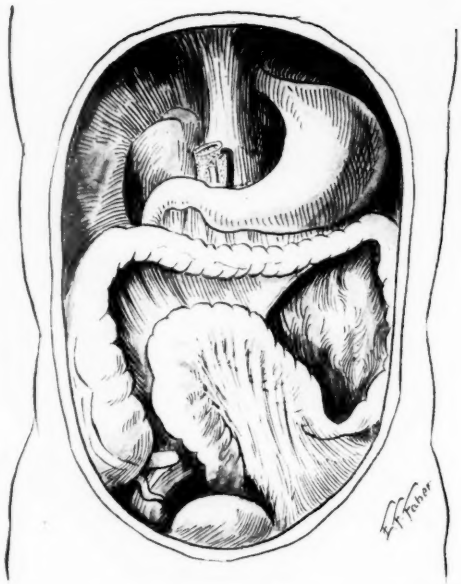

Fig. 10. Immense cecum and ascending colon, and sigmoid colon, owing to strictures at hepatic flexure and beginning of sigmoid colon.

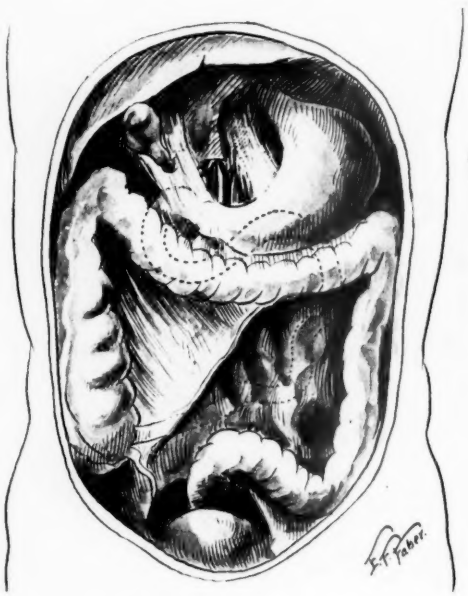

Fig. 11. Marked hepatico-duodenal ligament. Sharp angulated hepatic and splenic flexures.

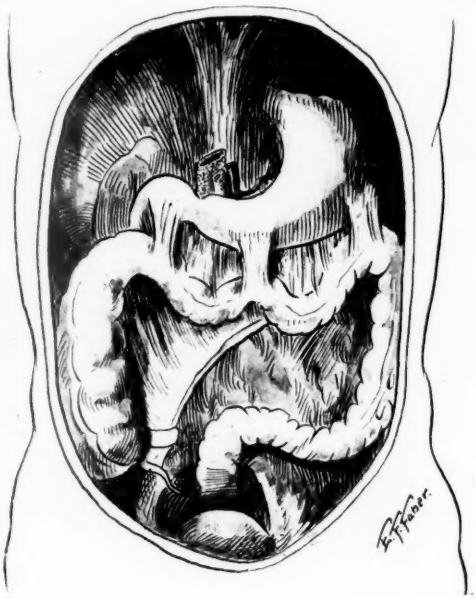

Fig. 12. Peritoneal bands passing from greater gastric curvature to transverse colon. Note suspension by stomach of transverse colon.

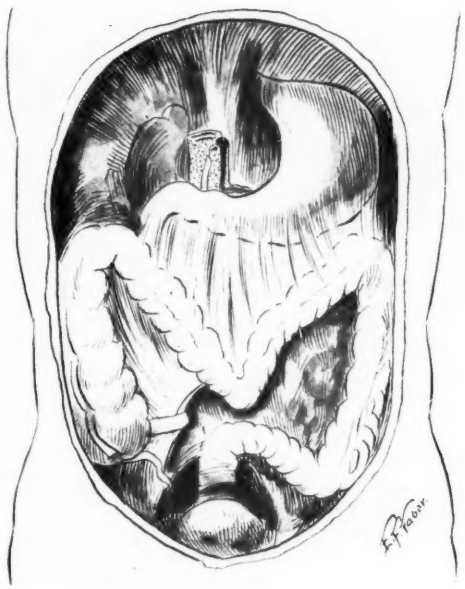

Fig. 13. V-shaped ptosed transverse colon. No ptosis of stomach owing to long gastrocolic omentum. Note development of bands in gastrocolic omentum.

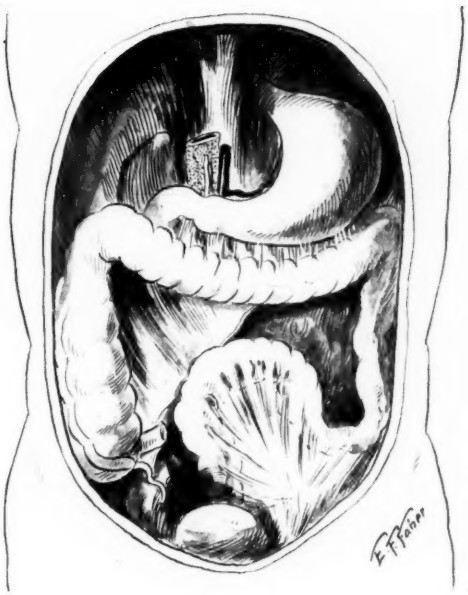

Fig. 14. Large sigmoid with mesenteric bands on under surface. The sigmoid was adherent to the anterior abdominal wall.

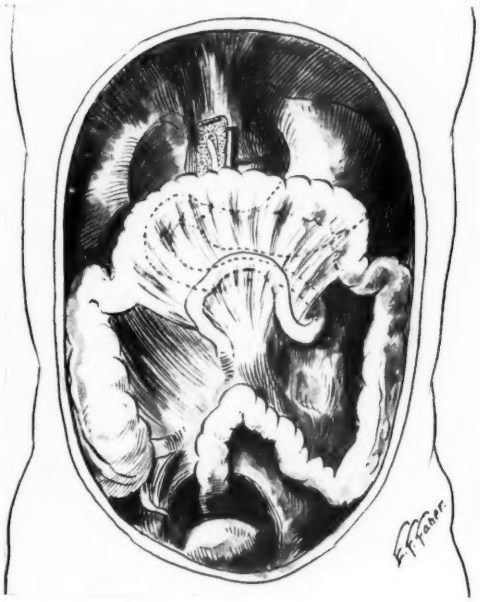

Fig. 15. Adhesion of loop of small intestine to under surface of transverse mesocolon.

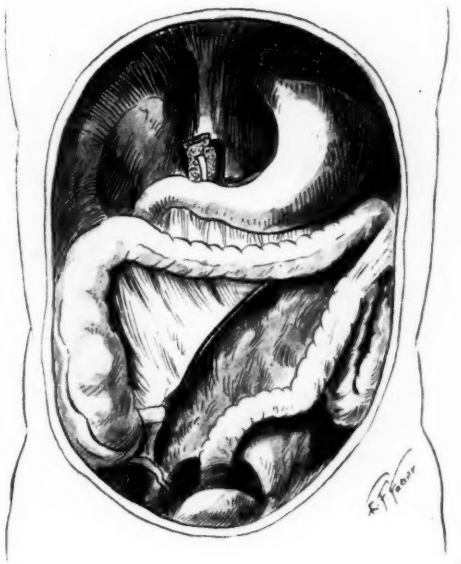

Fig. 16. Anomalous sigmoid, producing a second splenic flexure of the colon.

Fig. 17. Cecal ptosis. Narrow basal attachment of sigmoid colon by stout mesentery causing narrowing of the lumen of the proximal and distal portions of this bowel segment.

omentum is insufficient to act as an effective suspensory ligament of the stomach, since in addition to the stomach this structure must also maintain the superior position of the transverse colon, which usually lies closely related to the greater gastric curvature. While plication of the gastro-hepatic omentum in some cases may support an empty stomach and colon, the additional weight of these hollow viscera, when filled with foreign material, is a factor of great importance.

The second and most important factor inducing a gastroptosis is the anatomical relationship of the transverse colon to the stomach. While gastroptosis is almost always accompanied by a descensus of the transverse colon, the reverse is not necessarily the case, as will be shown later. The omental attachment of the transverse colon to the greater curvature of the stomach is firmer and much stronger than the attachment of the lesser gastric curvature to the liver. It follows, therefore, that yielding on the part of the lesser omentum will be more frequently observed, a deduction borne out by examinations both on the dead and the living subject. Of all factors tending to produce gastroptosis, therefore, the partial suspension of the transverse colon by the stomach is the one which appears to account most logically for ptosis of this organ. The descent of the stomach manifests itself in a tendency to alter the shape and lumen of the duodenum, and therefore, symptoms ascribed to gastric are in reality of duodenal origin. The alterations in contour of the stomach are shown in the illustrations Nos. 1, 3, and 9.

Duodenum. Any departure from the normal in the anatomical arrangement or disposition of the small intestinal coils is dependent upon the development (length and attachments) and shape of the mesentery. Careful inspection has shown anomalous conditions either at the beginning of the small intestine (duodenum), or at its termination (Lane's kink of the ileum). Proper emptying of the stomach is dependent upon the free patency of the duodenum, which is determined by its course and muscular tone, as well as by the pyloric sphincter action of the stomach. Its patency is altered at once by compression or traction.

When the duodenum assumes a decided V-shape, the lumen is constricted so as to produce an acute angulation, which is sufficient to impair the proper drainage of this organ. The absence or presence of a well-defined ligament of Treitz is important in determining the acuity of the duodeno-jejunal flexure. An anatomical relationship of considerable importance is the relation of the superior mesenteric artery to the anterior surface of the third portion of the duodenum. This large artery passes over the duodenum emerging from beneath the inferior surface of the pancreas. The weight of the coils of the small intestine, which hang suspended from this vessel embedded in the mesentery, is sufficient to induce a tension of the vessel which, acting on the surface of the duodenum, will mechanically cut off the patency of its lumen. The practical importance of this observation has already attracted the attention of many surgeons, who assure themselves that no torsion

of the mesentery exists in this region before closure of the abdominal incision.

The abrupt occurrence of postoperative gastric dilatation may be due to duodenal closure from this external force. Since the prone or knee-chest postures adopted in treating such patients are the attitudes most conducive to relieve this pressure on the anterior duodenal surface, the assumption that these anatomical factors underlie the production of this condition seems, at least partially, to be sustained by measures taken for relief.

The patency of the jejuno-ileum is conspicuously free of obstructive factors until we reach the terminal portion of the small bowel. Lane has well emphasized the acute angulation of the ileum in the vicinity of the ileo-cecal valve by the production of a stout band of tissue, which becomes separated from the mesentery and passes to the region of the right sacro-iliac joint. This band is by no means a constant structure, and is not limited to the very end of the ileum. Similar bands are also sometimes seen tying the ileum to the right iliac fossa and involving the appendix. I would add to Lane's so-called "kink of the ileum," the immobility of the ileum often observed when the terminal portion of the small intestine is firmly bound down in the vicinity of the right sacro-iliac joint. The latter condition is only a result of an exaggeration of the forces which act to produce the first variation.

It is obvious that this mechanical obstruction at the termination of the small bowel will offer much interference to its proper drainage, as illustrated by the dilatation observed in the portion of the small intestine proximal to the stricture. The kink is of V-shape, with the apical point directed either above or below.

The causes for stasis of the small intestine are best sought in this locality.

Colon. Cecal ptosis is quite common, and often exists to a degree which causes this portion of the large intestine to hang over the brim of the pelvis. The effort to compensate for this departure from the normal, on the part of nature, is the production of bands which pass from the lateral parietal peritoneum to the lateral and ventral surfaces of the cecum and ascending colon. Whether these bands represent the cause or the effect is a question open to discussion. The ascending and descending colon in eighteen per cent of cases (Jonnesco) has a mesentery. The absence of a mesentery in the case of the cecum is explained on the basis that this portion of the colon is never anchored in place, and is probably movable throughout life. Its original position is subhepatic, and from this position it grows down into the right iliac fossa. Should the adhesion of the lateral cecal wall to the parietal peritoneum take place, the primitive broad peritoneal reflection becomes converted into one or more well-marked attenuated bands, owing to the muscular contractions of the partially fixed cecum in its efforts to disengorge itself. Reasoning in this manner, the presence of these bands is not so much an attempt on the part of nature to compensate for an anomalous defect, as the direct result of faulty development, tending to obstruct the physiological purpose of the cecum. These bands are fairly common, and are not confined to the cecum and ascending colon. I have seen such adhesion to the abdominal wall often involving the summit of the sigmoid colon.

The ileo-cecal junction is one of considerable interest and often presents interesting variations. The kink in the ileum at its termination, and the complete immobility frequently encountered, are two of the three anatomical factors involving this important break in the continuity of the gut-tube. The other variation of considerable importance is the mode of insertion of the ileum into the cecum. The ileum not infrequently appears to lie behind the cecum and to project into the lumen from this peculiar position. When filled, the entire weight of the cecum lies on the ileum at its junction and compresses the ileo-cecal aperture.

The mesentery of the appendix has long been known to be a factor of considerable importance in sustaining the position of the cecum in the iliac fossa. The appendix should properly co-operate in this manner, since the meso-appendix is derived from the mesentery of the small intestine and is definitely fixed to the posterior wall of the body cavity.

Ptosis of the cecum exerts traction on the meso-appendix, with the subsequent interference with the patency of the lumen and the blood supply of the appendix.

Great cecal dilatation is almost invariably the result of acute angulation of the colon at one of the flexures. This resultant narrowing of the bowel lumen may be marked at the hepatic or splenic flexures, or the transverse colon may present one or more points of constriction produced by peritoneal bands.

This dilatation may be developed to an extraordinary degree without the ascending colon sharing in the process. The degree of acuity of the hepatic flexure is the result of two opposing forces: (1) The colon may be anchored to the inferior surface of the right hepatic lobe by peritoneal attachments of the liver, gall-bladder, and duodenum. The adhesion to the gall-bladder and duodenum is frequent and throws the support of the colon upon the hepatico-duodenal ligament which represents the thickened right border of the gastro-hepatic omentum. (2) The marked fixation of this flexure with the subsequent dragging of a much distended transverse colon is sufficient to narrow the lumen of the bowel in this region to an extraordinary degree. If the colonic ptosis is complicated by a gastroptosis, the superadded weight of the stomach only tends to increase the forces at work, narrowing the lumen of the bowel at this flexure.

The transverse colon may occupy a position high up in the epigastrium, or describe a loop reaching as low as the crest of the pubes. This portion of the large bowel, both in the living and in the dead, more frequently lies on a level with the umbilicus than above this point. Extreme types of ptosis of the transverse colon accentuate the hepatic and splenic flexures, by rendering the sigmoid angulation at these turning points in the course of the bowel more acute. The stomach may follow the transverse colon in its downward course, although the gastric descensus is determined by the length of the transverse meso-colon, as well as by the length and strength of the gastro-hepatic omentum. The descent of the transverse colon is not necessarily accompanied by descensus of the stomach, but the reverse is always the case, since the transverse colon and its mesentery are very important structures in the formation of the so-called stomach bed.

It would seem, therefore, anatomically impossible for gastroptosis of any degree to exist without an accompanying transverse colonic ptosis.

The transverse colon may present one or more abrupt breaks in the line of continuity, owing to sharp angulations produced by variations in the omental structure attaching this portion of the gut-tube to the body wall. Bands passing upward over the anterior facies of the stomach, or downward to become continuous with the mesentery of the small bowel, are frequently observed.

What is true of the hepatic flexure obtains in the consideration of the splenic angle of the colon. One often sees enormous dilatation of the cecum, ascending and transverse colon, abruptly terminating at the splenic flexure. The reason is at once apparent, since examination of this region discloses a sharp sigmoid curve with narrowing of the lumen of the bowel at this point. Below this flexure a narrow and contracted descending colon is usually observed. So constant is this observation that first inspection of the viscera, when the abdomen is opened, will disclose the individual dilated segments of the colon, and the distinct limitation of the distension of the gut will localize the obstructing factor at the distal end of the enlarged loop.

The descending colon is probably subject to less anatomical variation than any other portion of the large bowel. The downward course of the fecal current, in the absence of obstruction of the bowel lumen at the sigmoid colon, is designed to cause the least possible trouble in the discharge of the bowel contents.

The sigmoid loop of the colon is subject to variation to a degree sufficient to preclude a statement of what constitutes a normal sigmoid. Several factors are of noteworthy importance in considering anomalous conditions of this portion of the gut-tube.

1. The sigmoid may be tightly tied down at its beginning by a short thick mesentery which constricts the lumen of the bowel when it describes the curve which is obliquely forward and to the right.

2. This loop of the large bowel may describe three-fourths of a circle, and the completion of the ring is occupied by the narrow basal attachment of the mesentery. A constriction of the gut in this region produces an enormous distension and a thinning of the intestinal wall. The musculature of the bowel obviously suffers in consequence and the expelling force is proportionately decreased.

3. One observes variations in the length of the sigmoid, from twelve to twenty-eight inches, and the tendency to compensate for the overmobility and angulation of the bowel at this point is the production of tense bands in the meso-sigmoid, some of which are almost of tendinous consistency.

4. The sigmoid may be no larger than the small bowel at its widest part. This is observed in those examples of a rather short sigmoid which passes over the promontory of the sacrum to the right sacro-iliac joint, and descends obliquely downward to terminate in the rectum. The bowel is tightly held to the structures over which it passes, is not mobile, and mesenteric bands pass to the under surface of the mesentery of the small intestine. The lumen of the sigmoid of this type may show one or more marked constrictions. This is an anomaly of developmental origin, since the original common mesentery of the early undifferentiated gut-tube became attached to the posterior body wall in a faulty manner, with failure of separation of the mesenteries of the small and large bowel.

5. Enormous dilatation and elongation of the sigmoid are compensated for on the part of nature by the production of adhesions to the ventral peritoneal surface of the body wall. These are true adhesions, probably pathological in nature, and are not due to faulty development.

A CONSIDERATION OF THE COMPLICATIONS OF APPENDICITIS[1]

By J. N. HALL, M. D., Denver, Colorado

I HAVE been so much impressed in my work with the frequency of serious complications and sequelæ in appendicitis that I offer you to-day a review of the complications and associated conditions noted in my last 500 cases of appendicitis. The rather formidable list should not be regarded as being by any means a fair average for that number of cases, since a large proportion of the patients were first seen for the complicating trouble or were in a way selected cases, the simple cases not commonly being brought to the attention of another physician by the attendant.

I have record of the actual operation in only 349 of these cases, since in some no operation was advised, in others it was refused, in still others the patients went elsewhere for further advice or operation, but particularly because a majority of the cases were seen with 152 different physicians and surgeons scattered over a rather wide territory, and the results of operation, if performed, have often escaped me. Since no complication of note occurred in 135 of the operated cases, and relatively few are recorded in the 151 not operated, the greater majority of the troubles noted were found in 212 of the operated cases, several not infrequently occurring in a single case.

I should say in advance that under ideal conditions as to diagnosis and treatment I believe 90 per cent of these complications should have been avoided. I shall not consider in this connection, abscess formation or rupture into the peritoneal cavity as a complication.

The extension of an abscess took place into the following locations, as proven by its rupture, by operation or by postmortem examination: the liver nine times; subphrenic space eight times; right pleura once;

[1] Read before the Texas State Medical Association at Amarillo, Texas, May 11, 1911.

through right lung with perforation of bronchus and expectoration of pus once (I had seen it twice in a previous series); perforation into the pericardium once; perforation through the stomach and vomiting of pus of subphrenic abscess once; into right kidney once; around left kidney once; rupture through the abdominal wall once; rupture through the navel once; rupture through the bowel six times; rupture through the bladder once; rupture through the vagina once; rupture through the transverse colon once (subphrenic abscess); upture through the ischio-rectal space twice.

I have also seen this in a previous series. In one case severe taxis upon a right inguinal hernia failed to reduce it, and an abscess, breaking externally, arose from the damage to the appendix contained in the sac. (Operation upon resulting fecal fistula by Dr. Tennant; recovery.)

Abscesses were found three times in the abdominal walls. Two fairly typical pelvic abscesses similar to those arising from the female genitalia were noted.

General sepsis was seen in several hopelessly advanced cases.

Septic complications were noted in other organs as follows: definitely septic nephritis once; acute nephritis four times; chronic nephritis twice; pyonephrosis twice. Pus and blood cells were often noted in the urine without serious kidney infection.

Among vascular complications there were: pulmonary embolism twice; right hemiplegia apparently of embolic origin once; hemiplegia from cerebral thrombosis twice; pylephlebitis was present in several of the cases of abscess of the liver and subphrenic abscess. Phlebitis of the left leg is noted once, and double phlebitis once. I am certain that other cases have escaped record, perhaps through lack of any especial interest. In one case serious adhesions to the right iliac vessels were noted in chronic appendicitis.

Septic embolism of right thigh (amputation) occurred once; two emboli lodged in the left arm and wrist respectively, in the same case, causing abscesses. The emboli apparently originated in the branches of the pulmonary vein surrounding an extensive cavity in the lower right lobe, due to rupture of an ascending infection into the lung with perforation of a bronchus and coughing up of the foulest pus for twelve years. (I had seen this patient in his original attack some ten years previously.) This patient has gradually developed spinal curvature concave to the right, evidently from the contracting adhesions in the right abdomen and right lung. I saw a similar curvature following appendicitis in a physician some years ago.

Septic pericarditis has already been noted.

Jaundice was seen in three cases without very serious results, and the faint jaundice of sepsis was noted several times. In one fulminating case gangrene of the wound was followed by jaundice, acute atrophy of the liver, delirium, albuminuria with tube casts, leucin and tyrosin, and death on the fifth day. I regard this as a case of acute yellow atrophy of the liver.

Tetany occurred in one case with dilatation of the stomach after operation, with recovery. One case was operated for appendicitis with abscess formation during a temporary remission of pernicious anæmia, but died within two years of the original disease. In another patient who refused operation pernicious anæmia developed within a year with fatal results.

Fecal fistulæ were noted at the site of the operative wound several times. One instance of perforation of a subphrenic abscess into the colon with subsequent fistula was noted, the patient dying within a few days. In a case sent to Dr. W. W. Grant for operation and which I saw through his courtesy, two fistulæ were present through the lower abdominal wall, although the abscess had been opened by a surgeon in another state after it had broken through the rectum. The extensive loss of the cecal wall from a previous gangrene was repaired with full recovery.

In one case a foreign body (calcareous fecal mass) had escaped from the appendix, had become encapsulated, and was removed at operation long after, the perforation of the appendix having completely healed. In one case the tip of the appendix had become attached to the ileum and had perforated through its walls.

Aside from the type of dynamic obstruction dependent upon general peritonitis, fecal obstruction occurred in one case from an exaggerated Lane's kink, in two others from kinking of the ileum from contracting adhesions, in one from general adhesions, in one from strangulation in a postcecal pouch, in four cases from definite bands, two upon the left side (in one, thirty years after the original attack, with operation by Dr. Craig, and recovery). Obstruction from torsion of the transverse colon following contraction of adhesions about a previous appendicitis was noted once. Gastromesenteric ileus occurred twice and ileocecal intussusception with gangrene of the appendix once. One nurse was operated upon by Dr. E. F. Dean successfully within five years on four separate occasions, for recurring obstruction from general adhesive peritonitis following a suppurative appendicitis. In two instances bands had obstructed the pylorus and given rise to such dilatation of the stomach as to demand operation. The symptoms so much resembled those of pyloric ulcer that I made a false diagnosis of that condition in the first instance. In one case abscess followed immediately after a hard labor and two or three other cases suffered temporary exacerbations of chronic appendicitis from the same cause.

In two instances the cecum and appendix were found on the left side, in one a misplaced appendix and cecum being adherent to the left side of the uterus and being mistaken for a tubal involvement. The cecum was, of course, abnormally movable in this case. The movable sigmoid was attached over the appendix in one case.

Gall-stones were found upon operation eleven times, cholecystitis without stones once, and adhesions between the appendix and gall-bladder were present in several instances, although but one is definitely noted.

Acute dilatation of the stomach was present in four cases after operation. Chronic dilatation was found nine times; two of these cases already noted being due to the presence of a definite band, while the others were presumably due to pyloric spasm.

In one case of recognized typhoid fever a typhoid ulcer in the appendix perforated and was operated with success. In another instance of apparent acute appendicitis in a girl who had had typhoid fever, proven by Widal reaction two years previously, the trouble was caused by a large and typical typhoid ulcer within the appendix, with enlarged mesenteric glands close by. (Operation by Dr. Lyman, recovery.)

Appendicitis was noted five times in association with tuberculosis of the cecum, and in one case a tuberculous fistula persisted after operation. In two instances of pulmonary tuberculosis in which the appendical involvement was thought to be of tuberculous origin, no evidence of such character was found at operation.

Ulcer of the stomach was found four times at operation and in one case gastro-enterostomy had been previously done for duodenal ulcer.

In one case bleeding occurred from the navel, evidently through a patent urachus, and in another intermittent discharge of watery fluid from the same source had long existed, neither having any apparent connection with the appendical disease.

Hydronephrosis of the right kidney of more or less pronounced intermittent nature was noted five times. In two instances it was not recognized at the time of operation but was later diagnosed and operated, with recovery.

Several cases had parotitis, but the records show it in only two.

Serious secondary hæmorrhage from the wound of operation was noted twice, and in one case repeated hæmorrhage from the bowel occurred after opening an appendical abscess, doubtless from the gangrenous stump of the appendix. I have previously reported a similar case.

In one case the "wooden abscess" of the French and German writers was found, and in another a large granulomatous tumor, thought at first to be sarcoma, but containing a small focus of pus at the center; both recovered after operation by Dr. Freeman.

Postoperative lobar pneumonia, doubtless chargeable to the anæsthetic in several instances, occurred ten times.

The right lower lobe was involved seven times, whole right lung once, right upper lobe

once, left lower once, both lower lobes once. Thus, out of fourteen lobes affected the right lower was involved nine times and the left lung was involved but twice. This would suggest that an ascending infection accounts for pneumonia in appendicitis oftener than we commonly believe.

Associated with the appendical inflammation, we found many interesting conditions, often evidently purely accidental. Floating right kidney was present twenty-five times; horseshoe kidney once; calcareous mesenteric glands once; cancer of colon once; cystic ovary three times, strangulated ovarian cyst once; normal pregnancy twice; pregnancy in one horn of double uterus once; uterine fibroids three times; tuberculous tubes twice; salpingitis five times. In one case the leaking tube led to operation for appendicitis, of which there was a definite history. The appendix was an old offender in this instance, but guiltless of the acute symptoms.

Purpura hæmorrhagica with hæmatemesis occurred once; hysterical coma once; postoperative psychosis twice; local asphyxia affecting the toes of one foot occurred once; tumor of the brain once; prolapse of the transverse colon four times; prolapse of other parts of the colon five times; prolapse of the sigmoid once. In two instances the occurrence of a dry pleurisy in the lower left axilla was determined. I believe this to be a reliable sign, if pulmonary disease be excluded, of extension of a subphrenic abscess upward upon this side as in these two cases, and its presence should suggest most careful search for such a complication. I have seen the same sign in pancreatitis, and after rupture of gangrenous gall-bladder.

Foreign bodies in the appendix, aside from fecal concretions, were not frequent. Bird shot, various seeds, oatmeal hulls, bristles from a tooth brush, etc., were noted. No parasites were recognized.

A dark discoloration of the skin over the cecal region, as in two or three of these cases, is of some value in the diagnosis of chronic appendicitis. The accumulation of gas in the semiparetic cecum, its muscular coat unable to act properly because of the nearly chronic inflammation, leads to constant efforts to force on the gas by pressure with the hands, and the skin, from the frequent irritation becomes darkened and thickened.

One of those curious cases of mental aberration in connection with appendicitis was noted during the collection of these cases, but is not included, since it was not appendicitis at the time I examined it. The patient had been operated upon two or three years before and the appendix removed. Four subsequent operations had been performed, all by different operators, and five abdominal scars were distinguishable. Apparently adhesions had been present to some slight extent, but the woman's morbid desire to be operated had been the chief element in inducing men of comparatively little surgical experience to undertake the case. I advised against any further operation, but within a few months was called by another surgeon to see the same case again, and again she was disappointed.

In one case reported to me by Dr. Leonard Freeman, the symptoms of acute appendicitis seemed clear enough to justify operation at once. When the appendix was exposed it was injected and mottled, but without evidence of severe inflammation. As the patient was taken from the table it was found that a beautiful eruption of measles had broken out during the ether anæsthesia. The physicians in attendance believed that a direct relationship existed between the eruptive disease and the appendicitis. No such occurrence has come under my observation.

The vastly greater liability to ascending infection in retrocecal appendicitis should be recognized. I do not doubt that this is in part due to the difficulty of recognition of this type, and consequent failure of surgical intervention. The insignificance of certain important elements in the diagnosis, pain, tenderness and rigidity, because of the position of the appendix, contributes to the likelihood of error. If the case be not seen early, the obscure abdominal symptoms and continued fever give such a resemblance to typhoid as to deceive one easily for a time, as I know from experience.

Dysmenorrhœa is so frequent in appendicitis that the diagnosis of chronic inflammation of the appendix with adhesions to the

ovary or tube may often be made with considerable confidence. The coincidence of appendicular pain with menstruation is of value in the diagnosis.

Blood in microscopical amounts is a frequent finding in the urine of acute appendicitis, and yet in the majority of the cases we may feel confident that there has been no extension of the inflammation beyond the original seat. I have never learned of a satisfactory explanation. It is of importance chiefly because of the danger that it may confuse the diagnosis when as a matter of fact it is of minor significance.

I have been asked many times to examine the chest with especial regard to the differential diagnosis between acute appendicitis and acute pneumonia. The frequency of error in earlier days is well recognized, for many operators doubtless removed normal appendices in patients found later to have pneumonia affecting the right lower lobe as the real cause of the symptoms. I have previously reported a case sent to me as acute appendicitis in which the *left* lower lobe showed pneumonic consolidation the next day, no evidence of abdominal trouble arising during the remainder of his illness. I believe a diaphragmatic pleurisy is always present as the immediate cause of the reflected pain in the abdomen in this class of cases. Pneumonia is not easy to exclude in many instances of true appendicular inflammation, since, if the peritoneum be involved, the diaphragm becomes fixed through the extension of this inflammation. The portion of lung immediately above it is therefore subjected to less than the normal respiratory movement, the respiratory murmur is thus enfeebled, and dullness, doubtless from reflex circulatory disturbance, may often be demonstrated. This set of signs and symptoms should be sharply distinguished from the type of pneumonic involvement consequent upon extension upward of a septic process, propagated to the liver through the portal circulation, and thence reaching the lung. There seems abundant reason to believe that the lung may be invaded without the intermediation of a subphrenic abscess, the hepatic abscess leading to direct inflammatory adhesion between liver, diaphragm, and lung.

Chronic headache, digestive symptoms (mimicking gastric ulcer, especially when a fecal concretion is present in the appendix), neurasthenia, hysteria, inanition, and a dismal train of chronic disorders, follow so frequently upon chronic appendicitis, that we should strive to make the diagnosis in every case. Only to-day, I have seen a young woman who has had twelve attacks of somewhat atypical appendicitis dating back to childhood, with soreness, distress, and indigestion in the intervening periods. She has been so disabled with these troubles and the associated headaches that she has never been able to earn her own living. I do not doubt that a correct diagnosis with proper surgical help at the beginning would have turned the current of her whole life. (Since operated upon with excellent results.)

I have no especial comment to make upon the array of complications presented to you further than to say that it is evident that almost any course is open to neglected appendicitis. It behooves us therefore, to diagnose the disease and have the cases operated upon before serious para-appendical troubles begin.

SAVING THE HUNDREDTH MAN[1]

By W. P. CARR, M. D., Washington, D. C.

MUCH has been said in recent surgical discussions about saving the hundredth man. It is taken for granted that the good surgeon, in ordinary operations, excluding desperate cases, is saving ninety-nine out of one hundred, and that we are playing for the hundredth man.

Many excessive refinements of technique have been devised to this end. Some of them were so cumbrous or harmful in other ways that they were soon abandoned; but others, not so obviously harmful, are still in common use.

I am seriously afraid that in our excessive zeal in saving the hundredth we may sometimes lose the seventy-fifth and fiftieth patient, and even more of the bad risks that might otherwise be saved.

The fact that a certain method or refinement of technique is a safeguard against one danger, does not of necessity make its use advisable for it may prove dangerous itself in some other way, and that danger be greater than the measure of safety it affords.

Let us, first, briefly review the chief causes of death following surgical operations and consider our methods of defense.

Until recent years sepsis easily led the list with hæmorrhage and shock as next in frequency, and these three causes so far overshadowed all others that they sank into comparative insignificance. But as hæmorrhage and then sepsis were practically mastered, other causes became relatively more prominent. We began to recognize more fully the dangers of anæsthesia, of renal insufficiency, of gastric dilatation, of adynamic ileus, of myocarditis and atheroma and of complicating diseases in general, and of shock which is caused by complicating disease or intensified by it.

If we could have all our patients absolutely sound, except for the one condition for which we were operating, there would be practically no deaths with our present methods of operating. We would be talking about saving the one thousandth man or the ten thousandth man instead of the one hundredth, for we are losing very few cases to-day from sepsis, and that only when general or widespread infection has occurred before operating, or when resistance has been terribly lowered by toxæmia before operating.

In clean cases we lose practically none, and even mild infection is rare. We lose practically no cases from hæmorrhage, unless severe hæmorrhage occurred before operation. And if we had only sound patients to operate upon, there would be very few deaths from shock. Most of our deaths to-day are from complicating diseases which lessen the patient's resistance both to shock and to infection. We deal largely with persons whose opsonic index is low, and who are extremely susceptible to shock on account of their manner and habits of life, or some complicating disease, such as atheroma, myocarditis, renal insufficiency, neurasthenia, faulty digestion, chronic toxæmia from faulty elimination and other evils of city life and lack of outdoor exercise. We have all noticed how quickly and easily the laborer in the ward recovers, and how much shock and debility follows the same operation on a man of sedentary life. All this goes to show the great desirability of getting our patients in the happy condition of perfect physical soundness before operating, except, of course, for the condition or conditions necessitating operation. This, of course, is impossible in most cases, and yet much may be done, much more than we are doing as a rule.

Careful examination of the general condition and of all the vital organs should be made in every case, and an attempt made to get the patient in ideal condition, unless immediate operation be imperative. At least, we should not operate upon patients with intermittent pulse, or during renal crises, or with sugar loaded urine, or in grave neurasthenic conditions, until we have conscientiously tried to get them into better shape, unless it

[1] Read before the Washington Surgical Society, April 20, 1911.

is absolutely necessary. We should no more operate under such circumstances than during attacks of acute disease, such as pneumonia or typhoid; but we must also guard against the other extreme of waiting too long when the surgical condition itself is diminishing the patient's powers of resistance faster than we can build them up. However, a careful examination, a complete diagnosis, not only of the surgical condition, but of all complicating diseases, should be seriously and carefully attempted in all cases, and the patient put in the nearest approach to sound health possible under the circumstances. Taking the opsonic index for the usual germs of infection may be desirable or even important in some cases, with appropriate vaccine treatment when indicated.

With patients in the ideal condition, and with modern technique, neither hæmorrhage nor infection need be feared in clean operations though bacteriologists tell us that few wounds are really free from contamination. The patient's tissues are able to destroy the few germs that gain entrance. Fortunately the only unavoidable contamination in most cases is with comparatively harmless skin germs. But even these comparatively harmless organisms should be excluded if possible, and as far as possible, for when the patient is not in ideal condition, or when even the wound is not in ideal condition, they may cause serious, though not often fatal, infection. They should be excluded absolutely, if it can be done without causing more harm in some other way. But it is even more important to have both the patient and the wound in as nearly ideal condition as possible, both during and after operation. Too much credit cannot be given to asepsis; for it is the great factor which made possible the saving of ninety-nine out of one hundred. But it reached a state of practical perfection several years ago, and but little improvement has been made since that time, except in the use of iodine in preparing the skin, and but little more can be expected. But we must remember that asepsis is not the only factor in preventing infection, and, indeed, that even in its present perfection it would seldom prevent infection without the aid of resistance in the tissues. Even perfect asepsis would not insure against autoinfection from the few germs not infrequently found in the blood of apparently healthy persons.

We must therefore look for the greatest improvement in preventing infection to come from increasing resistance and preventing shock; and preventing shock means increased resistance. Some surgeons are a bit skeptical about shock, because we cannot definitely define and limit the term. There is, however, a well recognized condition which for want of a better name we call shock. It is just as much a reality and just as much a potent lethal factor, as if we understood it in all its phases. I use the word shock in its widest sense, in the sense of a condition of lowered vital force, evidenced by diminished response to either normal or artificial nerve stimuli, by feeble response of involuntary muscles and of glands to either normal or artificial stimulation. These manifestations may be general, or more or less localized, as in cases of adynamic ileus caused by shock through the splanchnic nerves.

This condition of lowered response to stimuli may or may not be accompanied by great feebleness of the pulse and clammy skin. It may be produced by hæmorrhage, by pain, by intoxications, by prolonged or rough handling of viscera, or even by mental impressions.

Dogs may be killed by pain, pure and simple, with nothing to account for death but shock. Human beings invariably faint if sufficient pain be produced — but the amount of pain necessary to cause unconsciousness in an Indian is enormously greater than that required to make a neurasthenic city man faint. The Indian has vastly greater power of resisting shock.

We are all familiar with the classic experiment of pretending to bleed a criminal to death and actually causing his death through mental shock without the loss of a drop of blood. And some of our patients come to operation in very nearly that condition — call it what you will. The immediate cause of death may be cerebral anæmia. But it is anæmia caused by a failure of vaso-constrictor muscles to respond to normal stimuli — and

that is shock. Now let us examine more specifically into the causes of shock and see what we may do to prevent them. First mental or psychical shock, the chief causes of which are fear of death, dread of pain, hopelessness of relief, or even a lack of interest in life resulting from long invalidism, or domestic causes. A thousand other things may enter in as more or less potent factors.

In persons of neurasthenic type, even the dread of exposure of the person, and worrying over it, may produce quite profound shock. The anticipation of an operation, with continued pondering over all its serious possibilities for days or perhaps weeks, aided and abetted by suggestions from thoughtless friends who relate all the grewsome details of other cases, of failure and death, and suffering, though they may have no similarity to the case in hand, may produce shock, or a condition of melancholy favoring shock, that is serious and yet unnoticed by the surgeon. Many patients have told me of such things, after it was all over, and of the enormous feeling of relief from a depression they hardly realized themselves until the relief came of finding themselves really getting well after the operation.

We have all seen patients who knew they would die of the operation, and have seen some of them do it too, for no reason, apparently, except the fixed impression that they would die. And we have seen others carried through crises apparently only by their fixed determination and belief that they would *not* die.

These things are familiar enough to us all, but I am afraid that in the busy routine of work we do not think of them enough and take time to act upon them.

A plain, cheerful, though serious, talk of even ten minutes will often relieve the patient of an enormous amount of imaginary fear and dread; and by a little study of the case, and skillful suggestion, he may be brought to the operation in a hopeful and cheerful frame of mind, in most cases.

A common practice, which cannot be too severely condemned, is that of carrying the patient upon a stretcher to the anæsthetizing room and allowing him to remain there fifteen or twenty minutes, or even longer, practically unnoticed, while waiting for some one to give ether, or for the operator to arrive. I have often thought this must be a most trying ordeal and that those twenty minutes must seem like twenty hours to the man waiting and momentarily expecting the cone to be put over his face.

Mental shock is also in many cases a strong contraindication to local anæsthesia. I have no objection to offer to the use of local anæsthesia in minor operations upon most patients, nor even to its use in major operations upon patients of a phlegmatic type; but I do think it is to be condemned in major operations upon excitable, imaginative, or neurasthenic persons. For even if they have will power enough to go through with the operation, without complaint of physical pain, the mental suffering and shock must be very great, and the resistance of the tissues to infection is certainly lessened by the injection even of Schleich's solution or sterile salt solution. Pain is a cause of shock, both mental and physical; but need not be discussed here as we seldom produce pain nowadays in operating. Hæmorrhage is another powerful cause of which I shall say nothing as every competent surgeon knows its evil effects and how to prevent or overcome them.

The most important causes of shock over which we have any control are prolonged operating, prolonged and rough handling of viscera and nerves, and the necessary concomitant of prolonged anæsthesia. I have always insisted, and still insist, that we must make the operation fit the patient; or rather, make it fit the patient's condition. Many a patient will safely stand operating for half an hour, who would not stand it for an hour.

How common it is to see a patient go along nicely for half an hour, or perhaps three-quarters of an hour, and then suddenly collapse without any apparent cause except the cumulative effect of the same causes of shock he stood so well at first. There is unquestionably a limit beyond which it would not be safe to prolong any operation upon any patient.

But this limit varies enormously with the magnitude of the operation and the condition

of the patient. It may be five minutes or it may be five hours.

Usually we know fairly well about what the patient can stand, and plan our work accordingly. Sometimes the patient begins to show signs of collapse before the operation is actually begun, showing that the anæsthetic alone may cause collapse.

Therefore, in bad risks, no time should be lost in scrubbing, washing, or arranging towels and sheets, after the patient has reached a stage of surgical anæsthesia; but all this should be done during the etherization, and everything be ready to begin the moment it is complete. While we can usually form a fairly good rough estimate of what a given patient will stand, we can not be sure. Collapse *may* come suddenly and unexpectedly in any case, so that no unnecessary delay should ever be tolerated. This does not mean hurried and slighted work. There is no surer way to lose time than to become hurried to the point of excitement. For concrete example let us say we have a large appendical abscess in a very ill patient whose life would be jeopardized by more than five or ten minute operating. We should simply open the abscess — perhaps with local anæsthesia, a matter of two or three minutes, leaving the appendix to slough away or be removed later, whereas, if the patient's condition seemed to warrant it, we would sponge out the pus, remove the appendix, and perhaps drain through the flank, closing the abdominal incision. Sometimes it may become necessary to abandon part of a planned operation or to leave a wound open with hæmostats in place under the dressings rather than attempt to tie them off and close the wound at a serious risk to life. And yet by a careful study of our cases such as is advocated in the first part of this paper, and by a careful preparation when possible, by a careful estimate of the patient's powers of resistance, and the planning of a suitable operation for each, such hasty abandonments will be rendered extremely rare and much will be done toward saving the one hundredth man. The gravity of profound shock can hardly be over estimated, and the condition is frequently masked or misnamed for one of the complications it may cause.

It seems reasonable to believe that acute gastric dilatation or torsion, and intestinal paresis, are frequently but symptoms of shock, or at least are caused by shock. It may also be the direct or indirect cause of cerebral anæmia, anuria, or renal insufficiency, of lowered resistance and consequent infection, of lack of digestive secretions and of many less grave conditions, and will unquestionably aggravate every other evil condition and form an extra segment in every vicious circle. After the patient comes under the anæsthetic our best means of combating shock are proper conditions of heat and moisture in the operating room, and the rapid carrying out of the operation, which should be planned carefully and as well as possible beforehand, with all its possible complications. Very important also is the skillful administration of the anæsthetic by a trained anæsthetist.

Sometimes the excessive details of aseptic precaution are allowed to occupy too much valuable time. Every precaution of real value should be observed — but too much time should not be consumed in the slow and deliberate spreading of many towels and sheets after the patient is ready, nor in too frequent changing of towels just because they are bloody.

Some nurses try to place in a clean towel every few minutes regardless of what the operator is trying to do, and some assistants would not keep a sponge out of the wound long enough for him to get a glimpse of it, if left to their own inclinations. The indiscriminate routine use of gloves also leads to loss of valuable time not otherwise compensated for. I shall have more to say of gloves in another connection. I am convinced that our chief advance in the future, both in lessening shock and lessening infection, will be in the line of cleaner, neater, and quicker operating, and in the leaving behind of less bruised and mangled tissue and small blood clots.

Dr. LeGarde, in a recent paper before the medical society of the district, said it had been conclusively shown that gunshot wounds are one thousand times more susceptible to infection than clean incised wounds. And that this is due to the bruised and necrotic tissue surrounding the track of the bullet,

and the small clots in its course. It may be due in part also to the shock which usually attends gunshot wounds. This should be a warning to surgeons against undue pinching and bruising of tissues with forceps and against incomplete hæmostasis, and especially against ligating *en masse* and strangulation with too numerous and too tight suturing. The importance of these things has been frequently taught, but was never so forcibly impressed upon me as by Dr. LeGarde's statement.

The use of gloves seems to be objectionable for several reasons.

First, they interfere to some extent with our sense of touch. In spite of all assurances to the contrary, by a few operators, I am forced to believe this statement true. It is admitted by most surgeons, in varying degree, and I must conclude that those who deny it have never achieved the "tactus eruditus" of which we used to hear so much and of which we now hear so little. It has even been said that there is no such thing as a "tactus eruditus," or that if it exists at all it is in the brain and not in the fingers. But there is such a thing. It can easily be demonstrated. And while the brain is needed to interpret, the sensitive finger is also necessary to receive, the impression.

Let anyone get a large number of small objects of nearly similar size and shape in a bag and see how easily he can distinguish each individual object with the naked fingers and how difficult it becomes with even the thinnest and best fitting glove. If he cannot notice the difference at once, I do not hesitate to say that his fingers have never been properly educated or that he is lacking in a delicate sense of touch. No amount of practice with gloves will entirely overcome this handicap. I used gloves daily and continually, in the dissecting room, and in operating upon the cadvaer for students, for several years, and in about a thousand postmortems. They were the same gloves we wear to-day in operating. I became well accustomed to their use before we began to use them in operating to any great extent. I think I can use them now with as little handicap as the average surgeon; perhaps I can do a little better. But they are a handicap. Some men are exceedingly expert with gloves, but they would be at least a trifle better without them. Men who have always used them have become more and more expert with practice — and do not feel the handicap, because they have never experienced the more delicate touch without them, at least not often enough to realize the difference, and yet it may seem a small matter, and in most operations perhaps it is, but in some cases I am sure this one thing is the determining factor of life or death for the patient. I believe firmly that more patients have died from the use of gloves than have ever been saved from infection by their use. Indeed, I shall endeavor to show, and I believe it is true, that they even cause more infection than they prevent and thus increase the very danger they were designed to prevent.

As I have said, they interfere to some extent with the sense of touch. This means the possible overlooking of some important lesion, especially in abdominal work where it is customary or should be customary to take advantage of the open abdomen to palpate the important viscera. Many an important lesion has been discovered and remedied in this way that would otherwise have remained unsuspected and necessitated a second operation or caused death.

Secondly, the glove leads to longer incisions which take a longer time to sew up and in other ways consumes time that in not a few cases is of life saving value. The glove when wet is exceedingly slippery, and when dry, often very sticky, especially in handling silk or linen sutures. This leads to delay. It is impossible to hold an intestine steadily in the gloved hand for suturing without covering it with gauze. This takes time and may even injure the peritoneal coat of the bowel so that germs penetrate its wall. So the glove increases the time of operating, almost imperceptibly in any one way, but in so many little ways that the aggregate is considerable. This means danger from shock and prolonged anæsthesia. More important than this is the fact that the glove leads to handling the tissues with forceps much more than would otherwise be necessary, putting the wound more on the plane of gunshot wounds and greatly enhancing the danger of

infection from germs in the patient's own tissues, blood, or skin. I have said nothing of faulty gloves, gloves with holes in them, or ill fitting gloves that are liable to be pricked or torn, for those dangers are now recognized, and none but perfect well-fitting gloves are *sanctioned* by any one, though frequently used by many.

So there seems to be quite an array of facts against the glove. Each may seem trivial in itself, but each under certain circumstances may prove the feather that turns the scale for life or death, and in the aggregate they form a serious indictment. In favor of gloves nothing can be said but the doubtful claim that they protect the patient against infection, to a very slight extent. Even if this claim were true it would not offset the disadvantages unless the protection afforded were more than even the warmest advocate of the gloves now claims. But I do not believe it is true. I believe that even in this essential thing for which they were devised they do more harm than good, and tend not to diminish but to increase infection by leading to prolonged operation, increased shock, and mangled tissue in the wound, larger wounds, and lowered resistance, both general and local. If we add to this the loss of delicate touch, which is becoming again more valued, then the verdict should be certainly against at least the *indiscriminate routine* use of gloves. That they protect the operator's hands is not really an argument in their favor. It is the acknowledgment of a necessary handicap. If we admit that to be the only reason for using them and that they are sometimes necessary for that purpose, then I see no objection to their use in cases requiring no special quickness or unusual reliance on touch, provided the operator be fairly expert even under the handicap. But they should not be forced upon those who do not need them. And I freely admit that some operators are vastly more expert with gloves than the average surgeon is without them. But such men would be a trifle better still without them, and to the majority they are a very considerable handicap.

It is believed by a good many that we can not sterilize our hands. Bacteriologically we cannot; but practically we can — perfectly. I may be pardoned for saying, not in a boasting way, but as a scientific fact, that I have opened the knee joint over two hundred times without a single infection — with bare hands. There is no better practical test of asepsis, for there is no part of the body more easily infected than the knee joint. During the past three years I can recall but one infection in a clean case, and for that I am sure I was not personally responsible. With that single exception, I think I have not had even a stitch abscess in any clean case in three years. There are a number of you present who have seen much of my work. One or another you have seen nearly all of it during the last three years. If I have forgotten or overlooked any case of infection, I should like to have it brought to notice.

To recapitulate briefly, it seems that in saving the one hundredth man we must pay more attention to the following things:

I. A careful study of our patients and a careful endeavor to get them into as nearly ideal condition as possible.

II. Avoidance of preoperative shock.

III. Diminishing operative shock by (*a*) skillful anæsthesia, (*b*) shortening the time of anæsthesia and operation, (*c*) avoiding rough or prolonged handling of viscera and important nerves.

IV. Rapid work will be greatly facilitated by knowing beforehand just what we are going to do and doing it, not hurriedly, but without hitch or delay. We should always see that sharp knives, scissors, and needles are ready, and all necessary instruments.

V. Leaving our wounds in ideal condition is of more importance than is generally believed.

VI. Gloves should not be used in cases where clean, rapid work is of paramount importance.

DEPARTMENT OF TECHNIQUE

TREATMENT OF UNUNITED FRACTURES

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IN considering the treatment of delayed union or non-union of fractures, it is important to determine whether the cause is due to a constitutional or local condition. Although many general conditions have been attributed as the cause of failure of union, it is very probable that in most cases the fault is some local trouble. The constitutional disturbances such as the presence of infectious diseases, pregnancy and lactation, prolonged illness, central nerve lesions, anæmia or any exhausting condition, are of importance probably from their influence in depressing general cellular activity. Crile's theory of fright as a cause of non-union following fractures is of undoubted value. In experiments upon animals he has found that sudden fright causes a degeneration of cells of the central nervous system, and as patients often receive a severe fright at the time the accident occurs, he attributes the failure of union in these cases to its effect upon the central nervous system.

During the past year the reader has encountered two cases of ununited fracture in patients who were apparently strong and healthy, but both of the patients gave a history of being severely frightened at the time of the accident. However in both of these patients at time of operation a local condition was found that might account for the non-union.

It is very likely that the interference to union in most cases is due to one of several local conditions, such as overriding of the fragments, a separation of the fragments by the interposition of fascia, muscle, or cicatricial tissue, or to disturbances of the blood or nerve supply.

In nearly all of our cases we have found that the ends of the fragments were separated by some soft tissue, and that these cases are usually in patients who have sustained a violent injury so that the ends of the bone have been forced past each other with great force.

Bone is a special tissue and there will be no callous formation unless one fragment actually comes in contact with the other in some manner. Therefore in order to secure union in any fracture it is essential that the bony tissue of one fragment actually comes in contact with bony tissue of the other fractured end.

In ununited fractures there are different degrees of insufficiency of union. In some there is a large callus thrown out surrounding the fragments, but ossification fails to take place and the callus remains soft. In others there is a fibrous connection between the fragments in the shape of bands. Less frequently than either of the above there is an entire absence of any form of union between the ends resulting in great freedom of motion of the fragments, and occasionally a fairly perfect joint is formed at the seat of fracture. In the first class of cases it may be simply a delayed union, and ossification may take place of itself later on without any special treatment. In the two latter classes union never takes place except from some special form of treatment.

In every case of non-union it is well to look carefully into the general condition of the patient, and if any constitutional disturbance is found which might possibly be a causative factor of the delayed union, treatment directed toward relieving this condition should be instituted at once.

In cases in which union has been delayed only a short time, it is well to keep in mind the fact that the cause in most cases is due to imperfect apposition of the fragments and insufficient immobilization. Should any displacement be found this should be corrected at once without operative measures provided the surgeon can secure an accurate apposition of the fragments and be able to retain them in this position with a fair degree of certainty by the ordinary means at his command. Should this be impossible operative measures which will be described later should be instituted.

In cases in which the apposition is good and a large callus has formed but bony union has not occurred, an effort should be made to stimulate the activity of the bone tissues by some form of local irritation. One of the most common and probably most efficient means of stimulating the

reparative process is by friction of the two ends, one upon the other; this is most easily and completely done under anæsthesia. When sufficient friction has been accomplished the part should be immobilized as thoroughly as possible. Another method of irritating the tissues and stimulating their activity is by injecting various substances into the callus and tissues about the site of fracture. Of the various solutions recommended, the use of alcohol and tincture of iodine have proved the most satisfactory in our work. Van Schmieden has recently recommended the injection of the patient's own blood into the callous area. The blood acts as a simple, non-infective irritant.

In all cases of true non-union, that is in cases which are not simply a delayed union, the treatment should be an operative one and preferably an open operation. Most authorities are in favor of an open dissection of the fracture with resection and fixation of the fragments, but there is still a considerable difference of opinion as to the best method of fixation. The method chosen should be one which will not only keep the two ends from slipping away from each other, but will actually hold the fragments from movement in any direction. Various methods of fixation of the fragments in ununited fractures of the shaft of long bones have been devised, such as the suturing with silver wire, catgut, silk, etc., the use of pegs, nails, and screws, the use of White's or Parkhill's screws and clamp, and fixation by the application of steel plates after the method of Mr. Arbuthnot Lane. Although the silver wire is probably more often employed than any other means of fixation, it has the objection that with it one cannot obtain an absolute fixation. The other suture materials mentioned are open to the same objections. Pegs, nails, and screws may be used to advantage when the fracture has been sufficiently oblique, and are also available with the Volkmann "step method" of dovetailing the fragments. The Parkhill clamp has the advantage of giving a rather firm fixation, and can be removed as soon as the fragments have become united, but has the disadvantage of having the screws in the bone communicate with the skin, predisposing to infection.

Fixation by use of the Lane steel plates is the only method which gives an absolute rigidity of the fragments and at the same time does not leave open any avenues for infection. The method consists in making a formal dissection, exposing the fractured ends. Any soft tissue between the ends of the bone is removed. The ends of the fragments should be freshened by means of a sharp curette, or chisel, or saw, using great care not to injure the periosteum. The two fragments are now adjusted to each other, securing as broad an apposition as possible, and then fixed in this position by screwing two steel splints to the sides of the bone, fastening the fragments securely together.

In non-union cases it is especially important that the bones be well plated, by using large sized plates, and being careful that the holes for the screws are drilled of proper size so that the screws fit tightly. If possible it is well to suture the periosteum across the line of fracture after the plates are in place. The wound is closed without drainage. The extremity is immobilized by splints or plaster of Paris for a period of two weeks, when the wound is dressed and the stitches removed. Some form of immobilization should now be used which can be taken on and off easily as the patient is given daily massage beginning three weeks after the operation. The use of gentle massage to the parts will improve the circulation in the extremity and bring more blood to the region of the fracture, which undoubtedly favors the process of repair. The extremity when taken from its retentive apparatus should be handled carefully, also the massage should be given gently so as not to put any undue strain upon the fixation splints. The immobilization of the extremity should be continued until one is sure union has taken place. In the reader's experience this period has varied from eight to twenty weeks.

In cases in which there seems to be no attempt at bony repair or no evidence of callous formation after the ordinary means of treatment, Dr. Judd of Rochester has devised a method of treatment which consists in placing an ivory plug into the medullary canal of the fractured bone. The principle involved is the same as that in cases of chronic osteomyelitis in which new bone is formed around a sequestrum.

The ivory plug is placed so that it extends into the canal of each fragment at least one inch and is held in place by a linen thread tied about the plug and drawn up out of the skin wound. The plug is intended to take the place of the sequestrum and act as a stimulant to the bone producing cells of the marrow.

In ununited fractures of the neck of the femur, whether intra- or extracapsular or both, treatment by direct fixation by the open method should be the operation of choice. Many methods of securing this fixation have been devised, such as the driving of ordinary nails into the two fragments, as originated by Trendelenburg, and first used in this country by Willy Meyer in 1892.

A. J. Gillette has devised the use of ivory pegs for securing fixation, and more recently the use of nails, made from coin silver has been introduced by Wilson of Philadelphia. Nicolaysen of Norway practices the use of ordinary nails without making an incision, simply driving them directly down and into the fragments.

The reader uses the long wood screws as a means of fixation as practiced by Mr. Lane. It has the advantage over the various forms of nails in that one can draw the fragments in closer apposition, the screw does not loosen as easily as nails and it can be introduced with greater precision.

The technique consists in making a free incision with its center over the great trochanter, and exposing the upper three inches of the femur. Traction and abduction of the extremity is made by an assistant while the surgeon determines whether or not this brings the fragments in accurate apposition. If bony apposition is not accomplished in this manner, the dissection should be carried forward, the capsule opened, the fragments freshened by a sharp curette, and the fragments brought into accurate apposition. A steel screw about three inches in length is selected, and a hole somewhat smaller than the screw is drilled through the femur at a point about one inch below the great trochanter, passing through the neck into the head of the bone. The screw is placed and turned in until the two fragments are drawn into close apposition. The wound is closed without drainage. A Buck's extension is applied and about twelve pounds of weight attached.

Gentle daily massage should be begun after the wound is completely healed and the stitches have been removed.

In non-union of the patella fixation may be secured by placing two small steel plates after Lane's method, although suturing with silver wire or chromic catgut is the method most generally used. The plates for these cases should be thin and very carefully applied. After the edges of the patella have been freshened, the fascia together with the periosteum should be stripped back a short distance and two plates screwed onto the fragments underneath the periosteum. The edges of the fascia and periosteum are sutured together over the plates and across the line of fracture with fine chromic catgut.

After the wound is healed, gentle massage is used, but no motion of the knee is allowed until union has taken place.

Between January 1, 1910, and February 1, 1911, the writer operated upon fourteen cases of ununited fractures. The cases were as follows:

Shaft of femur	1
Neck of femur	3
Tibia and fibula	4
Patella	1
Humerus	2
Ulna and radius	2
Radius	1

The steel plates were used in all except the three fractures of the neck of the femur, which were treated by the use of the long screw.

Union has taken place in all cases in which the plates were applied. Union has probably taken place in the three cases of non-union of the neck of the femur as the patients have been relieved of their pain and are all able to walk without the aid of crutches. So far the plates have had to be removed in only one case.

A NOTE ON MECKEL'S DIVERTICULUM

With a Series of Cases of Acute Intestinal Obstructions Due to It

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THE percentage of cases of intestinal obstruction quoted in text-books as caused by a Meckel's diverticulum is extremely small, viz., two per cent. The following, occurring during my six months' house surgeoncy, serve to show how one may meet with a series of examples of an uncommon condition in quite a short period of time. Furthermore, the diversity of conditions found at operations in these cases quite well demonstrates some of the vagaries which this embryological remnant may assume.

Although Rutch called attention to the condition as far back as 1698, Meckel in 1812 was the first to give a precise account of the anatomy of this diverticulum in relation to intestinal obstruction, hence its name.

Perhaps before passing on to a consideration of the clinical aspects a few words on its embryology would not be remiss. In the early human embryo the umbilical vesicle or yolk sac is large and communicates freely with the midgut; as development proceeds, the communication becomes narrow and elongated, forming with the omphalomesenteric vessels, which pass to the yolk sac, the yolk stalk. The sac which is attached to the chorion of the placenta together with its stalk becomes gradually smaller and should finally disappear. The persistence of the structures constituting the yolk stalk, that is, the omphalomesenteric duct and its accompanying vessels, form a Meckel's diverticulum, and, depending on the relative degree of obliteration, the varying types are produced.

The following is the classification given by Eisendrath:

1. A complete canal opening at the umbilicus at one end and into the ileum at the other, comparatively rare.

2. A canal opening at the umbilicus but ending blindly at a variable distance within the abdominal cavity.

3. An intermediate portion of the duct remains, having no communication externally at the umbilicus or internally into the gut, but forming a cystoma due to retention or secretion.

4. The tube is limited to the proximal end of the canal opening into the ileum — Meckel's diverticulum.

5. The cord containing the umbilical vessels may persist as an independent structure and be attached to the umbilicus separately. This vascular cord may either take an independent course, or the vessels may run along the free border of the mesenterioleum of the diverticulum, or finally they may run from the tip of the diverticulum and form a cord, commonly known as the terminal ligament.

6. The diverticulum may be either absent or very rudimentary, and the only evidence of the presence of a congenital condition be a cord (containing the umbilical vessels or traces of them) extending from the mesentery to the umbilicus.

Case 1. G. H. T., aged 24, a bricklayer, was admitted to the Royal Victoria Infirmary on October 20, 1910.

History of present illness. The commencement was sudden 34 hours before admission and 1½ hours after his tea. Patient was seized with a very severe cramp-like pain across his bowels, bad enough to make him shout out and sweat. He had a feeling that if he could only pass flatus he would be relieved. Vomiting commenced two hours afterwards and continued during the whole night, but it did not relieve the pain. The pain, vomiting, and sweating continued until his admission.

Enemata were administered soon after his illness commenced but no relief or discharge of feces or flatus resulted. He had no urinary trouble.

Previous health had been good. He had never suffered from "indigestion" or any other abdominal illness.

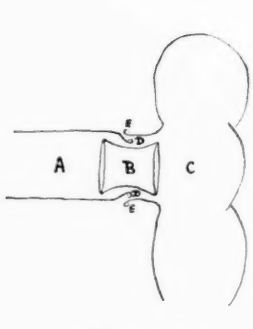
Condition on admission. He had the appearance of a strong, healthy man acutely ill and suffering greatly. He lay on his back with both of his legs drawn up. His tongue was moist and furred, pulse normal, temperature 96° F.

Abdomen. On inspection the whole abdomen was distended and respiratory movements were absent; no localised swelling or visible peristalsis. On palpation it was tender all over and there was marked rigidity, likewise general. (Four hours previously it had been noted that rigidity and tenderness were limited to the right side.)

On percussion, both flanks and a semilunar area with concavity upwards above the pubes were dull, and the dullness changed with every change of posture. (Four hours previously the dullness had been limited to the right side, the left being hyperresonant.)

Per rectum. There was fullness in front as of fluid in the recto-vesical pouch.

Diagnosis. All agreed that the patient had acute general peritonitis with a considerable quantity of free fluid in the abdomen. The cause of this was not clear, though the physical signs and the sex and age of the patient suggested ruptured duodenal ulcer. The only things against this were the absence of any previous history of indigestion and the constant vomiting since the attack. It seemed diffi-



Case 1. Fig. 1.

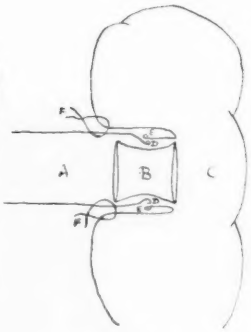
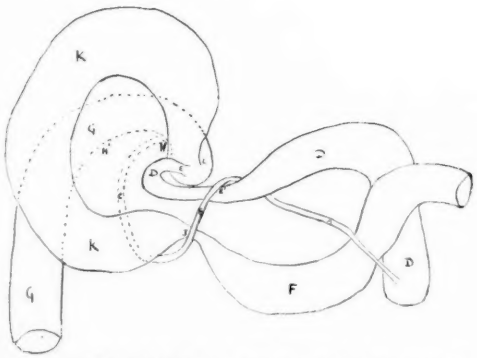


Fig. 2.



Case 1. DDD, Meckel's diverticulum; E, first twist in Meckel; E′, second twist in Meckel; L, volvulus of small intestine; H, attachment of band A B C; H′, mesentery of small intestine G G; GG, cecal end of small intestine strangulated by volvulus at L; KK, proximal end of small intestine strangulated by band A B C at J; F, proximal end of small intestine.

cult to explain the early general peritonitis, the presence of so much fluid, and the absence of more definite evidence of increased peristalsis if the case was one of acute intestinal obstruction as had been suggested.

Operation. Professor Rutherford Morison. The abdomen was opened in the middle line by excision of the umbilicus. A large quantity (about a quart) of very foul smelling greyish-coloured fluid escaped. The stomach and duodenum were normal. The incision was prolonged downwards, great care being taken to keep all the intestines in the abdomen. A mass of acutely distended strangulated bowel, with what was clearly a distended gangrenous Meckel's diverticulum (see photos), was exposed on the right side. The distended sodden bowel for about three feet above the obstruction was withdrawn from the abdomen along with the portion strangulated and the whole was excised.

The lower or distal end of the bowel was divided about three-fourths of an inch above the ileo-cecal valve and the proximal and distal end were tightly tied together with silk over a glass bobbin. This was pushed on (intussuscepted) into the cecum and fixed there by Lembert sutures attaching the ileum to the cecum. (The anastomosis by the bobbin required five minutes.)

The abdomen was washed out with abundance of hot normal saline (three grains of sodium chloride to one pint of water), a quantity of dirty fluid escaping from the pelvis. It was then closed entirely by tier suture in three layers.

All of the visible intestine and the parietal peritoneum were bright red but neither had lost its gloss and there were no lymph deposits.

As soon as the operation was begun intravenous transfusion was commenced and continued slowly during the whole procedure.

Steps of operation showing method of using glass bobbin:

1. Tie bobbin "B" fixed in proximal end "A" by means of a silk ligature D D. (The silk must perforate the mesentery of both ends.)

2. Tie bobbin "B" fixed in distal end "C" with distal bowel overlapping proximal (septic) bowel by means of silk ligature E E.

3. Intussuscept "A" into "C" and fix by means of Lembert sutures F F.

After progress. On the day following operation the patient had the appearance of a man entirely relieved of a serious illness and, except for some suppuration of the abdominal wound, made a straightforward recovery and went home on the 7th of November, 1910.

Pathology. On examining the specimen the following condition was found as shown by diagram and photographs; a fine cordlike band stretched from the apex of the Meckel to the mesentery of the small intestine.

The band A B C, commencing at the apex of the Meckel, passed over F, the proximal end of small intestine and then behind the Meckel, winding round it at E where the latter was twisted upon itself. The band, being tightly held by the twist, crossed the mesentery and small intestine at J, where it caused strangulation of bowel K K. It then passed behind K and was attached to the mesentery of bowel G G close to the origin of the Meckel.

D D D represents the Meckel. E the first twist, E′ the second twist. The Meckel was entirely gangrenous.

At L the bowel was twisted on itself, causing strangulation of G G, the cecal end of small intestine. This part of intestine was lying behind K K, the portion of bowel strangulated by the band A B C.

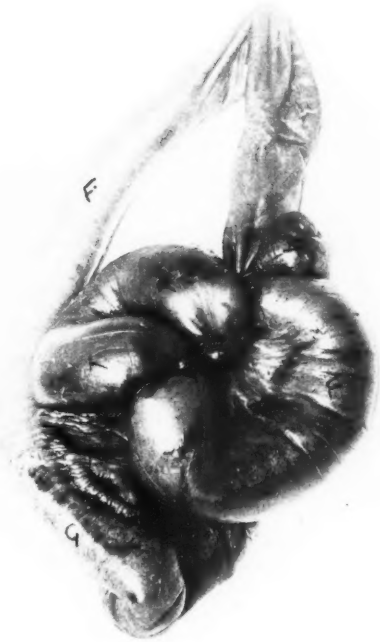
A B C, band stretching from apex of Meckel to mesentery of small intestine, which I believe to be the remnant of the Meckel, and its vessels.

Case 2. G. F., aged 16, an apprentice fitter, was admitted to the Royal Victoria Infirmary on July 14, 1910.

History of present illness. It commenced suddenly three and one half days before admission three-fourths of an hour after returning from a bicycle ride. He was seized with a very severe sickening pain. Nothing seemed to ease it and it continued all night, keeping him awake. During the night it became spasmodic and intermittent in character. Vomiting commenced eight hours after the onset of pain and continued until admission; it did not ease the pain. Occasional rumblings had been noticed by the patient. Flatus had been passed after administration of enemata with some relief to the pain. He had no urinary trouble.

Previous health. A similar attack occurred when he was nine years old but it was relieved by enemata.

Condition on admission. The patient was markedly emaciated and looked extremely ill. He complained of great thirst and was vomiting greenish yellow material which had a fecal odour. His tongue was dry and covered with a brown fur. Pulse 92, temperature 98.8°.



Case 1.

Case 1.

Abdomen. On inspection the whole of the abdomen was distended and peristalsis at the umbilicus of small intestine type was evident. On palpation there was no marked tenderness, but extreme rigidity was present over the left rectus immediately above the umbilicus.

On percussion both flanks were dull and the liver dullness was diminished, reaching one and one half inches from costal margin.

Per rectum. There was a well marked circular fold of mucous membrane on the posterior wall; immediately in front and to the right of this fold a small polypus about the size of a hazel nut could be felt.

Diagnosis. A diagnosis of intestinal obstruction was made; from the emaciated condition and appearance of the patient, together with his age, it was suggested that the obstruction was most probably due to a band resulting from tubercular peritonitis.

Operation. Mr. W. G. Richardson. The abdomen was opened in the middle line below the umbilicus. A small quantity of free fluid escaped. On drawing the distended small intestine upwards a distended Meckel's diverticulum was found lying with its tip in the pelvis. At the junction of the collapsed portion of ileum with the distended portion there was a valvelike orifice, produced by a tight band which passed from the gut at this situation to the mesentery; the vessels in it were thrombosed. Immediately the band was divided the Meckel's diverticulum collapsed.

The Meckel C was turned over to D and lateral anastomosis performed.

After progress. Patient was very ill for three days after operation, with pain in the abdomen and vomiting. Vomiting ceased with lavage of the stomach night and morning. Owing to persistence of the pain his wound was dressed. Definite peristalsis was visible. Oil and turpentine enemata were administered. Patient passed flatus next day with discharge of feces. Saline two hourly per rectum was ordered. From then onwards he continued to improve. He left the Infirmary on July 25th, with the wound healed by first intention. He returned on August 23d to show himself and said he had been quite well, except for an attack of pain seven days after he left the hospital. His general condition was greatly improved, and he had put on a good deal of weight.

Case 3. S. R., aged 11, female, was admitted to the Royal Victoria Infirmary on Wednesday, October 12, 1910.

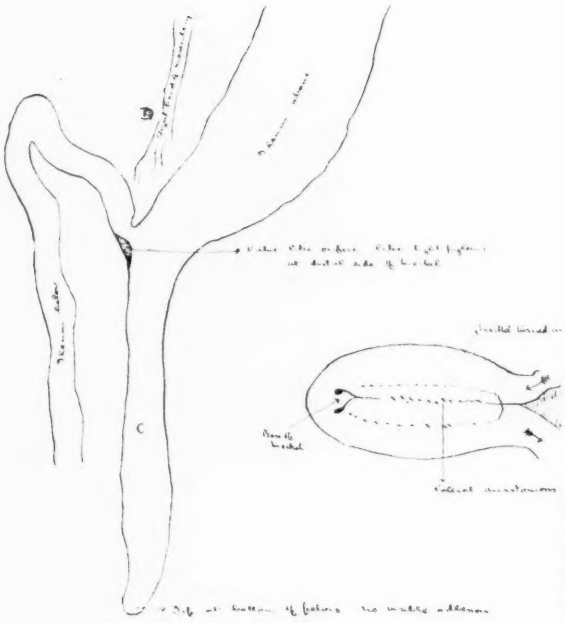
History of present illness. It commenced suddenly five days before admission. Patient was seized with very severe pain at the umbilicus which made her vomit. The pain became intermittent in character and was associated with rumblings loud enough to be heard by the patient. Vomiting continued, the vomiting gradually becoming foul smelling. Inability to pass flatus was marked from the onset of illness. Retching and eructations of gas troubled her considerably.

Castor oil and enemata had been administered by her doctor without any result. No urinary trouble.

Previous health had been good. No history of previous attacks.

Condition on admission. The patient was well nourished but looked extremely ill. Her cheeks were flushed and she was in a state of extreme collapse. Her tongue was dry and covered with a brown fur. Pulse 106 and very weak. Temperature 99.6°.

Abdomen. On inspection the abdomen was distended and there was marked peristalsis of the small intestine type at the umbilicus. A small sore about the size of a



Case 2.

pea was present at the umbilicus which was discharging seropurulent material.

On palpation there was tenderness at the umbilicus and manipulation set up definite rumblings. No tumour could be felt. Slight rigidity of the right rectus was present along with the tenderness.

On percussion there was dullness in the right flank. The left flank was resonant.

Per rectum. There was some fullness in Douglas' pouch.

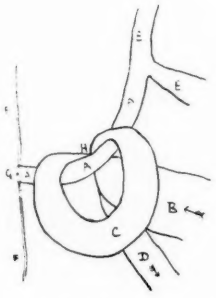
Diagnosis. There was undoubted intestinal obstruction; the sore at the umbilicus was suggestive of a granuloma, but as it had been present for an indefinite length of time, particular attention had not been called to it. With this history the persistence of a Meckel's diverticulum adherent to the umbilicus and forming a band suggested itself. There were no signs of tubercle.

Operation. Mr. Clay. The abdomen was opened in the middle line above the umbilicus. Distended small intestines were pushed aside and a loop of bowel was seen to be kinked over a band running from the umbilicus to the small intestine. The band was clamped at the umbilicus and the strangulated intestine freed. On examination the band was found to be a Meckel's diverticulum. The Meckel was resected and the stump turned in. The abdomen was washed out with normal saline and then closed.

After progress. Patient died suddenly nine hours after the operation.

Pathology. On examination of the specimen the lumen of the Meckel was patent up to the umbilicus but had no external communication. The diagram represents the condition found at operation.

CASE 4. Wm. J., aged 41, a miner, was admitted to the Royal Victoria Infirmary on September 11, 1910.



Case 3. F, abdominal wall; G, sore of umbilicus; H, seat of obstruction; AAA, Meckel's diverticulum; EE, small intestine with attachment of Meckel; C, strangulated intestine; B, ingoing bowel; D, outgoing bowel.

History of present illness. It commenced insidiously 36 hours before admission. Patient began to have some pain five hours after his supper in the region of the umbilicus. It became gradually worse, stabbing in character and shooting down towards the pubes. Vomiting commenced about six hours afterwards and the vomited matter consisted of yellow fluid. It did not relieve the pain which continued until his admission. The bowels were constipated. He had great pain before and whilst passing his urine and the quantity passed was small.

Previous health. Patient had been troubled for the past two years with attacks of indigestion (acid eructations without vomiting or pain). A heavy meal always made him feel uneasy. These attacks used to last for periods of a week and then pass off. He had lost one stone in weight recently.

Condition on admission. Patient was under the influence of morphia. His eyes and cheeks were sunken and he lay on his right side with his legs drawn up. Tongue very dry and coated with brown fur. Pulse 114, temperature 99.6°.

Abdomen. On inspection the whole abdomen was held rigid but not distended. On palpation it was extremely tender all down the right side with marked rigidity of both rectus muscles above the umbilicus. There was a well marked tender spot one inch above and to the right of the umbilicus. On percussion dullness was marked in both flanks.

Diagnosis. The boardlike rigidity with the tender spot and a history of indigestion seemed to point clearly to ruptured duodenal ulcer.

Operation. Mr. Richardson. Abdomen was opened in the middle line above the umbilicus. A large quantity of blood-stained, foul smelling fluid escaped. The stomach, duodenum and appendix were examined and found normal. The incision was then prolonged downwards. A strip of omentum was observed passing downwards into the pelvis where it was fixed. This was divided between ligatures. A large mass of distended small intestine was now drawn up out of the pelvis and a Meckel's diverticulum found tied in a knot and strangulating a loop of bowel. The whole of the implicated bowel was excised and lateral anastomosis performed. Abdomen was washed out with saline and then closed.

After progress. Patient never rallied from the operation and died the following night.

Case 4.

Case 4.

The following two cases are of interest in association with this condition:

CASE 5. Aged two days, was admitted to the Royal Victoria Infirmary on October 15, 1910, suffering from intestinal obstruction. There had been no passage since birth. There was no anal opening apparent. On examination under an anæsthetic, a small opening was found inside of and at the back of the vagina which admitted the point of a probe. Left inguinal colostomy was performed as an urgency operation by Professor Morison, and at the operation a portion of small intestine with a patent Meckel attached presented in the small wound. The child remained well until February 22d, when she was readmitted with retention of urine. On examination under an anæsthetic the rectum was seen to be communicating with the exterior at the lower part of the posterior vaginal wall. Though a probe was all that could be passed at the first attempt it was dilated to admit of the passage of a No. 13 rubber catheter, which after introduction appeared through the colostomy opening. The retention was relieved by catheter, but catheterisation had subsequently to be performed night and morning. Death occurred from bronchopneumonia three weeks later.

Postmortem. Iodiopathic dilatation of the bladder and ureters was found. The rectum was normal, except for its external communication. A small Meckel's diverticulum, about one inch long, with its closed distal end free in the belly, opened into the ileum thirty inches from its termination. The condition is seen in the appended photograph.

CASE 6. W. J., aged 3, female. Admitted to the Royal Victoria Infirmary on November 9, 1910.

History of present illness. It commenced suddenly one week before admission. While playing patient was seized with cramping pain at the umbilicus and vomited. Vomiting persisted until admission. Patient refused all food and lay in bed all day, complaining of stomach ache for three days. Subsequently the following day the pain became much worse, coming on in paroxysms. Her bowels were slightly moved at the commencement of the illness, but during the last two days no flatus or feces were passed.

Previous health. The mother stated that the child had had several previous similar attacks, which were always relieved by emptying the lower bowel with enemata.

On admission. The child was well nourished, looked ill, and was in a lethargic condition. Pulse 126, temperature 99.8°. Tongue dry and brown.

On inspection there was some distension, especially marked in the upper part. There was marked peristalsis of small intestine type in the region of the umbilicus on the right side. On palpation no tumour could be felt; the umbilicus was extremely tender. There was no rigidity of the rectus muscles.

Per rectum. Normal. No blood on examining finger.

Diagnosis. The child was undoubtedly suffering from acute intestinal obstruction, the cause of which was obscure. There was no history or other evidence of tubercle. Her age suggested intussusception. A provisional diagnosis of acute intestinal obstruction due to intussusception was made.

Operation. Mr. Martin. The abdomen was opened in the middle line above the umbilicus. Distended loops of small intestine protruded into the wound. On pushing these aside a tumour in the right hypochondriac region was found. On further examination it was seen to be an intussusception, the apex of which reached as far as the middle of the transverse colon. Reduction through the ileocecal valve was easily carried out by milking and traction. The bowel was healthy except that forming the apex of the intussusception which proved to be a partial invagination of a supposed Meckel's diverticulum, forming a polypus. This was ligatured and removed and the hole in the intestine closed by a purse string suture of silk.

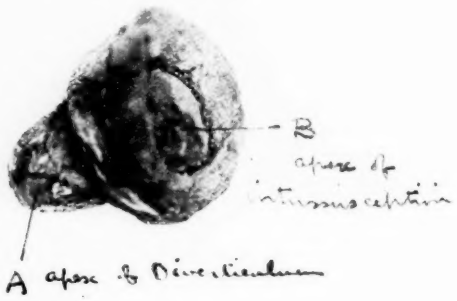
After progress. Patient was given saline every two hours per rectum, but never rallied and died twelve hours after the operation.

Case 5.

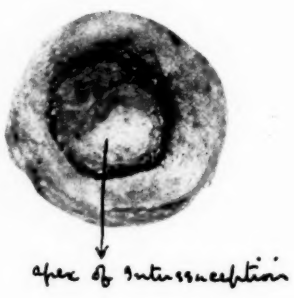
Pathology. The specimen (photograph magnified twice) appeared to be a Meckel containing a large amount of tissue which protruded into the lumen. This polypoid growth formed the apex of the intussusception. On microscopical examination the solid portion proved to be an accessory pancreas.

REMARKS

Consideration of the above cases, shows in all a history suggestive of acute intestinal obstruction and in the majority of cases one has no difficulty in deciding thus far. However, as instanced in case 4, it is not possible to arrive at even so gross a diagnosis as this, the symptoms and signs more closely resembling those of some of the other abdominal emergencies. After deciding that the case is one of acute obstruction it is often not easy to assign a cause. The diagnosis of a Meckel's diverticulum is rarely certain, but it can be and if so is usually by process of exclusion. The age of the patient is of little value as evidenced by the cases. The general health of the patient may assist for it has usually been excellent and there have been no previous illnesses. Tuberculous peritonitis is one chief cause of obstruction in young adults, but in this we usually obtain a history of previous illhealth and abdominal illness and the patient's present condition is often poor while other signs may be observed. It is noteworthy that in the above cases tenderness and rigidity in the region of the umbilicus were signs met with and these are certainly not commonly observed in acute obstruction due to other causes. A discharging umbilical sinus of indefinite duration, to which no satisfactory cause can be assigned, also points strongly in favour of the presence of an underlying Meckel. Further, as in case 5, a Meckel's diverticulum may be present with intestinal obstruction, but may take no part in its causation. This case also shows how congenital defects may occur together. The occurrence of a diverticulum with an accessory pancreas is comparatively rare and cannot be differentiated from an ordinary Meckel, as in the case above, even after the abdomen is opened. (In addition to the cases cited above it has been my good fortune to see another of the same nature in a patient of my father's.) As with strangulation elsewhere, all stages up to gangrene of the affected bowel may be found and the clinical aspect of the case is correspondingly complicated with each change and the diagnosis is rendered increasingly obscure. A law in Professor Morison's clinic and one to which I am indebted for the greatest help, is that every one concerned should make one and only one definite diagnosis and be prepared to defend that to the best of his ability. Though the diagnoses above were those most favoured, the possibility of a Meckel's diverticulum was entertained in cases 1, 2, 3, and 6.



Case 6.



Case 6.

A PSEUDOHERMAPHRODITE

By THOMAS S. CULLEN, M. B., Baltimore, Maryland

CASES of this character are encountered from time to time, but are by no means common. As we had an excellent opportunity of studying this one carefully and as we were particularly fortunate in having most faithful illustrations by Mr. Brödel, I have thought it wise to place the salient features on record.

On May 7, 1902, I was summoned by Dr. E. R. Trippe of Easton to see a case of strangulated hernia, which he said needed immediate attention. The patient (N. C.) had had a hernia for several years and had been wearing a right-sided truss. The hernia had frequently come down for a short time but had always been reduced without much difficulty. This time it had been down for nearly a day and attempts to return it had proved futile. I advised immediate operation.

The following note was made: "The patient's general expression is half masculine. The face is well developed and shows a comparatively heavy beard. The upper lip resembles that of an adult male. In the median line the beard extends half way down the neck. The Adam's apple is not well developed or, at least, not at all prominent. In general appearance the hair over the head is that of a female; it is about eighteen inches long. The voice is masculine in type. The chest development is more masculine than feminine. There is a moderate amount of hair over the sternum; the mammary development is slight and there is a moderate amount of areolar pigment around the nipples and along their lower margins is a good quantity of hair.

The fingers are long and slightly more feminine than masculine in type. The thumbs, however, are distinctly masculine. The forearm and arm are fairly well covered with hair. The umbilical fossa is deep. The pubic hair is well developed and in the median line and also laterally extends upward to a point 2 cm. above the umbilicus. The legs and thighs are well covered with hair and are masculine in appearance. (Fig. 4.) The labium majus on the left side is well developed. On the right side it is also well formed in the lower portion but at the upper part is stretched out over a tumor that extends down from the inguinal region. No clitoris is to be recognized but in its place appears an organ suggesting a penis two inches in length and 2½ inches in circumference. (Fig. 1.) This can be traced to the lower border of the symphysis where it is recognized as a small cord. The glans is 1½ inches in length, 1½ inches from side to side. It is well developed in the upper portion. The lower portion shows a distinct furrow $\frac{3}{16}$ inch in depth and 1½ inches in length and ending ¼ inch above the meatus in a ridge. (Fig. 2.) The mucosa lining the furrow appears more delicate than that covering the glans. The prepuce is well developed and can be drawn down to cover fully one-third of the glans. The urethra proper is situated just below and posterior to the ridge commencing at the proximal end of the groove in the penis. It is distinctly female in type, and 2¼ inches in length.

The hymen is represented by a ragged ridge composed of numerous tags forming an elevation about 1 mm. in height around the vagina. The finger enters the vagina for a distance of 1¼ inches. Laterally the mucosa is smooth, but posteriorly there is a considerable amount of scar tissue. The width of the vagina is 2 inches. Laterally it extends up to the pubic bones. No cervix can be made out and on bimanual examination no pelvic organs can be detected. The rectovaginal septum is normal as far as it goes.

The mass in the right inguinal region extending downwards to the right labium majus is 7 inches long and on an average 3 inches in breadth. (Fig. 1.) It is elastic and everywhere resistant and can be pushed upward and downward over a wide area. The lower two-thirds are dull on percussion but no definite solid mass can be detected.

Operation at the Church Home and Infirmary, May 8, 1902. An incision was made over the tumor and by transmitted light the sac was seen to contain a good deal of fluid. This proved to be turbid, and of a yellowish color. Occupying the sac and projecting through the external ring was a knuckle of gut fully 4 cm. in diameter, also a testicle and a portion of the epididymis. (Fig. 3.) As we were rather doubtful about the condition of the gut at the point of constriction, an incision was made higher up in the abdomen. The inguinal canal was opened and, the internal ring having been severed, it was found that a loop of intestine fully 8 inches long had formed the hernia. As it was impossible to return the testicle, this together with the redundant sac was removed. The peritoneum was closed with catgut. Just over the femoral artery was a slight area of oozing

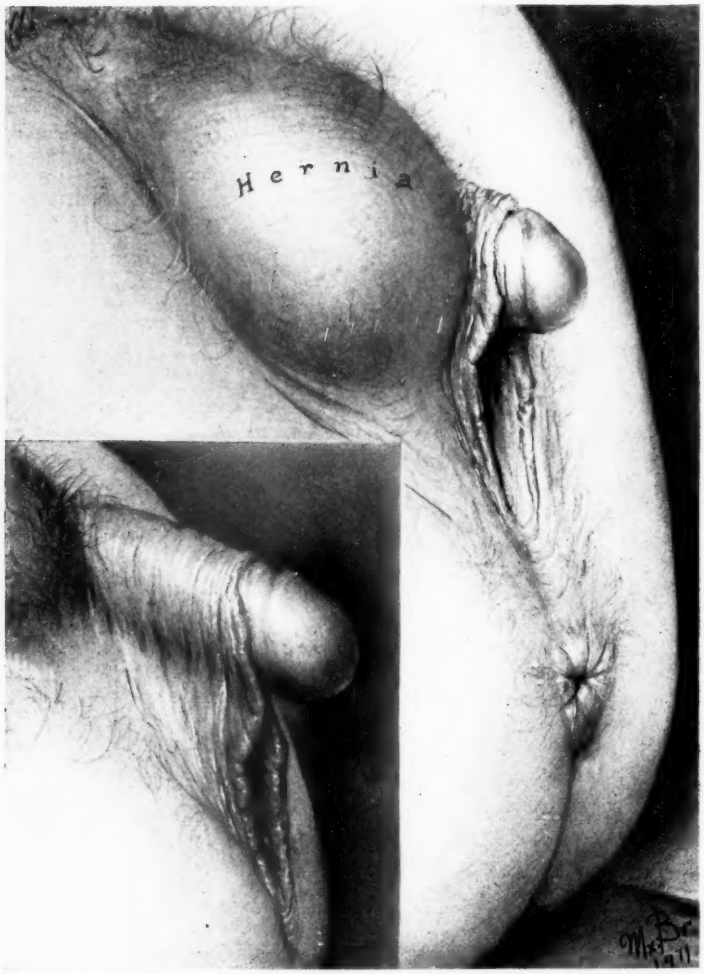


Fig. 1. Right strangulated inguinal hernia in a pseudohermaphrodite. The hernial sac is of moderate size and is encroaching on the right labium. The labia are continued upward forming the rudimentary prepuce.

In the sketch in the left lower corner the hernial sac has been pushed up exposing the penis which is over 2 inches long. The glans is well formed in its upper portion and the prepuce could be drawn down so that it covered one-third of its surface.

For the under surface of the penis see Fig. 2; for the contents of the hernial sac see Fig. 3.

which was rather difficult to check. Here we introduced a delicate drain of iodoform gauze. The abdominal walls were closed with silver wire, catgut, and subcutaneous silkworm gut. The patient stood the operation well. Before the abdomen was closed the pelvis was carefully examined and no trace of uterus, tubes, or ovaries could be found. On the left side a testicle could be clearly made out in the upper part of the inguinal canal, pressure upon which occasioned considerable pain. The patient made a speedy recovery.

On histological examination the testicle showed some minor changes. The gland epithelium was swollen, the cells closely suggesting the large squamous epithelial type; there was no evidence

Fig. 2 The imperfectly formed urethra in a pseudohermaphrodite. The glans penis is perfectly formed in its upper portion and above is provided with a rudimentary prepuce formed by the labia. The penile portion of the urethra is recognized in part as a groove, in part as a ridge. The urethral orifice is of the female type and is freely patulous to the bladder. The vagina is 1¼ inches deep and ends in a blind pocket. There is no evidence of a cervix.

of spermatozoa. The stroma of the testicle was increased in amount.

The epididymis was little altered.

ANATOMICAL POINTS OF DIFFERENCE BETWEEN THE NORMALLY FORMED FEMALE AND OUR PATIENT

Mr. Brödel, who had just read Stratz's book[1] on the female human body, suggested that it might be of interest to compare the superficial anatomical landmarks in our case with those laid down by Stratz as constituting the normal in the female. The accompanying tabulations give the interesting results as determined by Mr. Brödel after a most careful examination.

[1] Stratz, C. H. Die Schönheit des Weiblichen Körpers, Stuttgart 1900.

MEASUREMENTS OF AVERAGE-SIZED FEMALE (A) AND LARGE FEMALE (B) COMPARED WITH PROPORTIONS IN OUR PATIENT (C), THE BODY LENGTH OF B AND C CORRESPONDING.

	A Normal female of av. size	B Normal female of size of our patient	C Measurements of our patient
Length of body	168 cm.	183 cm.	183 cm.
Weight of body	132 lbs.	148 lbs.	170 lbs.
From nose to symphysis (length of spinal column)	62.5 cm.	68.5 cm.	71.5 cm.
Length of head	21 cm.	23 cm.	24 cm.
Width at temples	....	....	13 cm.

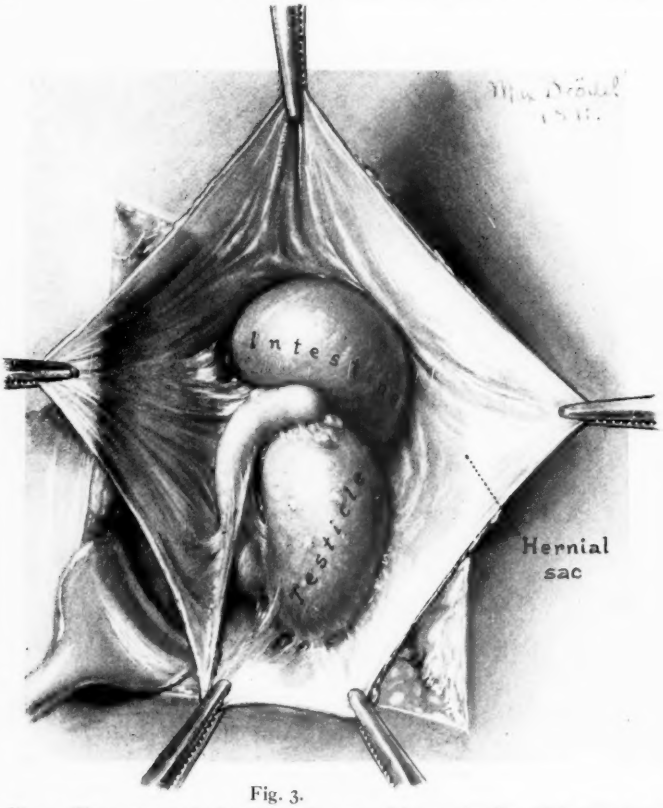


Fig. 3.

Fig. 4.

Fig. 3. The contents of a hernial sac in a pseudohermaphrodite. This mass was 7 inches long and 3 inches broad. It contained a considerable amount of turbid yellow fluid, a loop of small distended bowel, and the right testicle and epididymis. After the hernial ring had been cut, the bowel was reduced, but the testicle and epididymis were so firmly adherent to the sac, as noted in the picture, that it was necessary to remove them.

Fig. 4. Distribution of hair in a pseudohermaphrodite. The healed scar is readily seen. The pubic hair was well developed and extended upward a short distance above the umbilicus. The photograph does not show this very clearly. The legs were thickly covered with hair conforming closely to that of a male.

Leg (great troch.)	90 cm.	98 cm.	94 cm.
Circumference of chest	88.5 cm.	96 cm.	....
On inspiration	....	....	88 cm.
On expiration	....	....	84 cm.
Width of shoulders	38.5 cm.	42.5 cm.	....
Center of	....	....	33 cm.
Humerus	....	....	32.5 cm
Acromian process	....	....	32.5 cm.
Skin measurements	....	....	40.5 cm.
Width of waist	21 cm.	24 cm.	27 cm.
Circum. of waist	....	....	74 cm.
Width of hips at crest of ilium	34.5 cm.	38 cm.	31 cm
Width at level of great trochanter	34 cm.	38 cm.	32 cm.
Pelvis between anterior superior spines	26.5 cm.	29.5 cm.	27 cm.
Between post. sup. spines	12 cm.	13.5 cm.	11 cm.[1]

[1] Angle with central skin fold 90° (sacral triangle).

Nipples (center to center)	23.5 cm.	26 cm.	21 cm.
Nipple to umbilicus	....	....	28 cm.
Sym. to spinous process of 5th lumbar vertebra	....	....	23.5 cm.
Arm			
Length of humerus (axis of joints)	....	....	29 cm.
Length of forearm (axis of joints)	....	....	29 cm.
Length of hand	....	....	20 cm.
Circumf. of humerus	....	....	27 cm.
Circumf. of forearm	....	....	25 cm.
Leg			
Length of thigh (axis of joint)	....	....	44 cm.
Length of thigh from ant. sup. sp. to bottom of knee-cap	....	....	51 cm.
Length of leg	....	....	44 cm.

Height of foot	6 cm.
Length of foot	24.75 cm.
Circumf. of thigh	50 cm.
Circumf. of calf	34 cm.

SECONDARY SEXUAL SIGNS OF FEMALE

Normal	Conditions present in our patient
Delicate bones	Heavy bones
Rounded forms and contours	Mostly hard and angular
Prominent breasts	Flat — male type
Pelvis broad	Narrow — male type
Luxuriant hair on head	The same
Transverse low margin of pubic hair	Extending upward in midline
Little hair in axilla	Much hair.
No hair on face and body	Much hair
Tender skin	Thick skin
Rounded, delicate skull	Long, angular skull
Small face	Large face
Eye sockets, large	Small
Eyebrows, small	Heavy, bushy
Lower jaw, delicate	Strong — prominent
Lines from cheek to neck, graceful	Sharply demarcated
Neck, rounded	Prominent cartilages and muscles
Waist, slender and graceful	Heavy
Hand small and narrow	Fairly small
Shoulders rounded and sloping	Bony, broad shoulders
Clavicles, small and straight	Heavy, male type
Chest, long and narrow	Broad, male type
Buttocks, prominent	Small, male type
Thigh, thick and rounded	Relatively thin, male type
Low pubic curve	The same
Rounded contours of knee	Angular
Calf, rounded	Angular
Ankle, delicate	Heavy
Feet and toes, small	Large
Second and fifth toes, long	The same

FRACTURE CLAMP FOR OPEN TREATMENT OF FRACTURES[1]

By REXWALD BROWN, M. D., Santa Barbara, California

MODERN surgery becomes constantly more insistent that fractured bone ends be placed in accurate end to end apposition and so maintained during the period of repair. It is conceded that only through perfection in alignment can there be an assurance of ideal results. The inertia of the past is broken and the modern surgeon is not content to accept the accumulated authority of centuries as to the impossibility of securing better than more or less fair outcomes in certain types of fractures of long bones.

The X-ray having repeatedly demonstrated the failures in getting end to end apposition by the numerous external types of treatment, the application of appliances directly to the bone — the open method — logically followed. Several familiar means are at present in use, wire, nails, metal half cylinders, Lane staples and plates, and apparatus such as devised by Parkhill, Lambotte, and Freeman.

There are certain somewhat discouraging features at times with the use of these named. Wires frequently break during their application, due to twisting. Satisfactorily applied, they often break after the wound is closed, because they allow a very considerable play between the fragments and they are not of sufficient strength to resist the strain. Though the plates and staples hold the ends in much firmer contact than

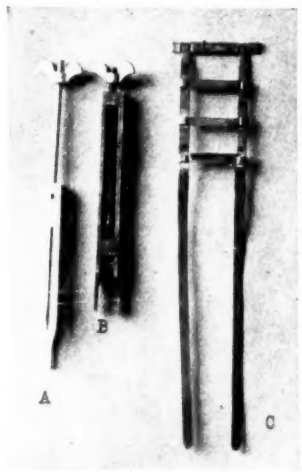


Fig. 1.

the wires, they are not always strong enough, nor do the screws always find sufficient purchase in the bone to withstand the various vertical and lateral strains. Hence there is breaking of the plates and staples, or pulling out of the screws. Following these unfortunate features the fragments either slip by each other, or become angu-

[1] Presented in discussion of Symposium on Fractures before Surgical Section, American Medical Association, Los Angeles, California, June, 1911.

lated, and open treatment has achieved no better results than would have the closed methods.

The Lambotte apparatus and its kind invite infection, for throughout the healing process there are open pathways along the screws from the external wound to the bone. The elimination of all factors tending to infection is absolutely essential in open handling of fractures, and there can be no further good in attempting improvement in apparatus which is partly within and partly without the body.

Consequently only material which can be buried will deserve attention in the future except perhaps in certain cases with special indications. It is, of course, clear that in the treatment of fractures by the open method the least possible amount of foreign body, consistent with maintaining the fragments in apposition, should be brought in contact with the bone and overlying tissues. Also its introduction should entail little trauma and time taken in application should be as short as possible. In this connection it may be said, however, that we do not know just how much foreign material the body will tolerate if it be introduced aseptically. This is a problem for investigation.

The good reports which have followed the use of metal half cylinders — a not inconsiderable foreign body — around broken bones leads me to make a preliminary presentation of a fracture clamp which I have recently devised. This clamp is made from a single piece of metal of good tensile strength and flexible. Our preference is for Russia iron, though silver, vanadium steel, and aluminum are serviceable.

The clamp consists of two long parallel bands tapering at lower ends and joined at the upper ends by a cross bar. There are two or three other cross bars equidistant from each other, the lowest somewhat above a point one-half way down on the parallel bands. The cross bars are elevated $\frac{1}{32}$ to $\frac{3}{32}$ of an inch above the parallel bands on one surface. Each end of the upper cross bar is perforated in such manner as to allow the passage of the corresponding long bands when bent circular. The clamp is made in various sizes adaptable to any of the long bones. (Fig. 1c.)

Fig. 1, a and b, presents two views of an apparatus, an adjuster, used in adjusting the clamp about a fractured bone. An adjustable screw running in an oblong bar of steel carries a catch. The bar has two legs slightly grooved on the inferior surfaces to fit against the upper cross bar of the clamp.

The steps in the application of the clamp can be best understood by a study of the accompanying pictures. An incision is made down to the fracture surfaces in the usual way. It is immaterial whether the fracture line be transverse or oblique. The ends are brought into apposition and held in contact by bone holding forceps combined with traction apparatus on foot.

A specially devised two-pronged aneurism needle, the eyes being placed longitudinally instead of vertically, is then carried over and around the bone, and moved distally and proximally along the surface of shaft to free the tissues on the inner side of the limb from the bone. The tapering ends of the parallel bands of the clamp are then caught by the eyes of the aneurism needle, and the clamp is drawn about the bone, one parallel band on either side of the fracture line.[1] (Fig. 2.)

If this procedure seems a little difficult for any reason, the bone ends may be unlocked and brought out through the wound, and the clamp slipped under the bone, the free ends of the parallel bands ahead. This method, however, necessitates bringing the fragments again into position, not always an easy matter, and causing more trauma, and requiring more time. Fig. 3 shows clamp placed for adjustment.

The parallel bands are bent to encircle the bone and the free ends are passed through the perforated upper cross bar and down snug by a heavy forceps. (Fig. 4.)

The free ends of the now circular bands are grasped in the catch of the adjuster and by means of the thumb screw drawn taut about the bone. (Fig. 5.) This accomplished the catch is loosened, and the circular bands turned back over the cross bar and cut off flush with the bar. (Fig. 6.) The two slightly upturned ends are then pressed down. This completes the procedure, the wound is closed and a cast applied.

This apparatus will be found to hold the fragments in almost a vice-like grip; there can be no fear of the fragments slipping by or of angulation. As wire when wrapped tightly about a bone has frequently produced periosteal necrosis, any other material constricting the periosteum would undoubtedly do the same. In this clamp it will be seen that the circular bands do not touch the bone, held above it about $\frac{1}{16}$ of an inch by the cross bars applied to the bone in its long axis, as are Lane plates.

The placing of the clamp is accomplished in very short time and entails no trauma to the bone,

[1] The ends of the circular bands could be made of unyielding steel and curved as the aneurism needles. The clamp would then be passed about the bone without there being necessity for extra instruments. The aneurism parts should then be cut off before proceeding to the adjustment of the clamp.

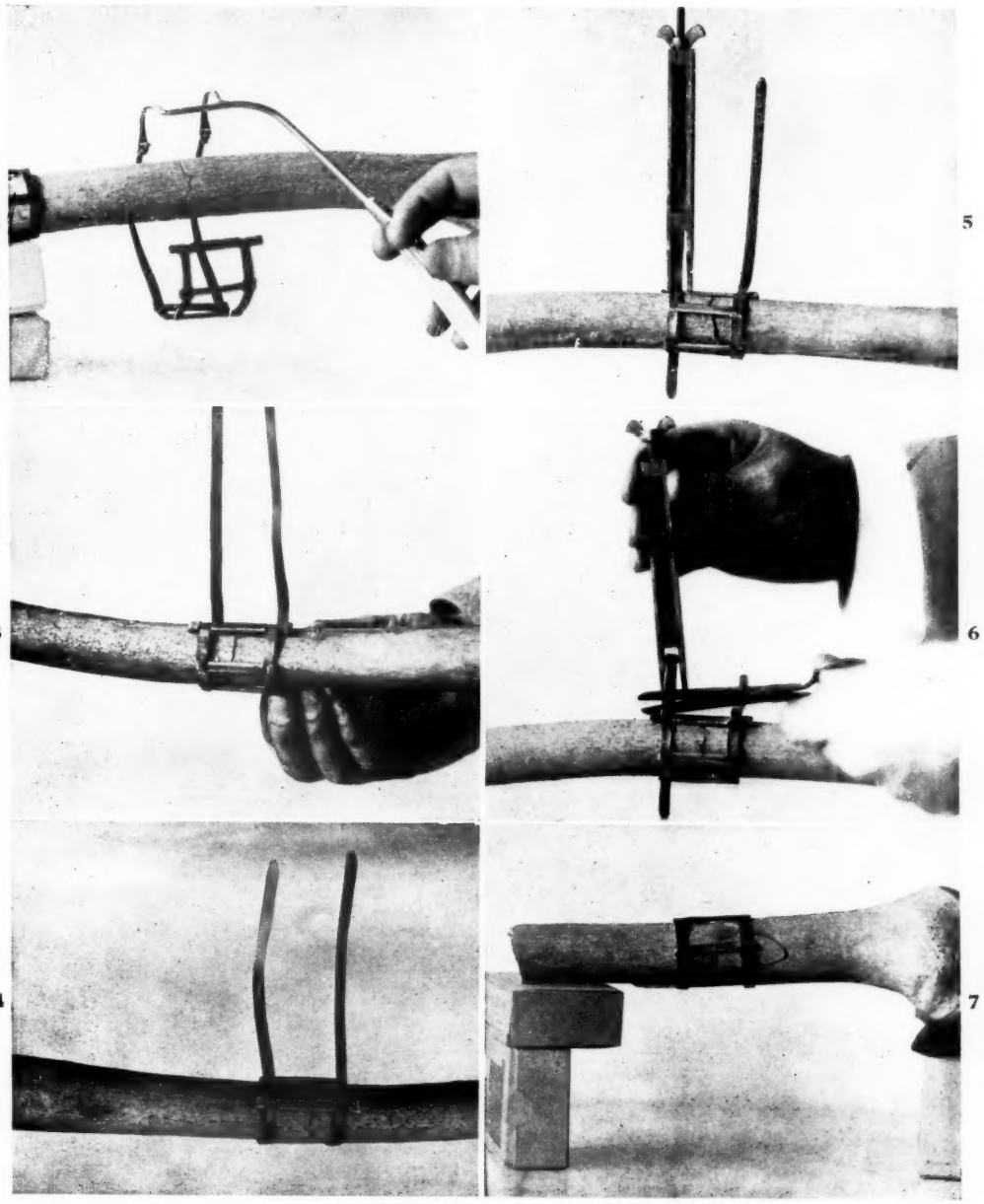


Fig. 7 shows spiral fracture with free fragment held in position by circular band. In fractures with considerable fragmentation this clamp with four instead of two circular bands would be serviceable, and in some oblique fractures one circular band will be found sufficient to hold the fragments in apposition.

as do wire, nails, staples, and plates requiring one or more drill holes. The trauma to the overlying tissue should be no greater.

The question that this clamp raises more than any other, perhaps, is this: Will a leg or an arm tolerate this amount of foreign material and not predispose to infection? My belief is that it will, for it is not as large in amount nor so cumbersome as a metal half cylinder, which has been tolerated.

No opportunity has been given me to determine the value of this clamp upon the human. I have applied it to the two bones in a foreleg of each of ten dogs after the bones were fractured. In these experiments no casts were applied to the legs after the clamps were adjusted. Three of the dogs after recovering from the anæsthetic walked on the fractured legs two or three days, until infection set in. The dogs were killed some four or five weeks after the operations and the clamps were found holding the fragments end to end. The bones were dead.

These experiments were hurriedly conducted and a number of adverse circumstances prevented our giving the dogs proper attention after the operations, and we found that the animals tore off their own and the others' dressings, bit out the sutures and licked the wounds till they opened down to the bones. Infection naturally followed, leading to periosteal necrosis. Lack of proper restraining apparatus made it difficult for us to redress the wounds, as many of the dogs were vicious. Experiments are under way under favorable conditions for the avoidance of infection.

I place this clamp before the profession trusting some members may find it of service, or if it be found not altogether practicable that there may be gained from it some idea which will lead others to produce apparatus that will win greater approval than wire, staples, screws, or plates and thereby lead to happier results in the management of fractures. My thanks are due Mr. Frank Stewart of this city for his assistance in devising the clamp.

NITROUS OXID–OXYGEN ANÆSTHESIA

With a Description of a New Apparatus

By E. I. McKESSON, M. D., Toledo, Ohio

UNTIL the last five or six years nitrous oxid had made little progress as an agent to be used in major surgery, but with the mixture of nitrous oxid and oxygen and the more refined apparatus for its administration, this anæsthetic agent has come into practical use for both major and minor work. We present the following description of an apparatus and our experience in its use as a result of an attempt to make nitrous oxid and oxygen an agent more easily and accurately administered, and more desirable for operative surgery than ether or chloroform.

The instrument as illustrated in Fig. 1 is composed of the apparatus proper and a stand upon which it rests. Instead of the regular stand as illustrated, a small standard may be screwed into the lid of the wooden case in which the apparatus is carried when it is desired to use it in the home.

The apparatus proper is a hollow casting with two side arms; each arm has two yokes for the attachment of gas cylinders, or any other gas supply. The gas as it leaves the cylinder from either side takes the following course: (Fig. 2) it passes through the arm and two-way valve to a gas groove which leads into the bag. From the supply bag it passes upward through the distributing valve and under the shaft valve into the mixing chamber. From the mixing chamber it passes through the radiator chamber and large rubber tube to the mask and respiratory passages of the patient. This is the course of the gas during inhalation.

In exhalation, the gas passes out of the mask under an expiratory valve into the air when the rebreathing valve is closed. When the rebreathing valve is open, the exhaled gas passes down the large rubber tube until the rebreathing bag is filled when the remainder of the gas to leave the lungs, lifts the expiratory valve in the mask and escapes into the atmosphere. This is especially desirable in rebreathing, since the very high percentage of CO_2 is found in the latter portion of exhalation. By this device all the gas may be saved which does not contain CO_2 and by adjustment of the rebreathing bag as much gas containing CO_2 may be administered as desired, the indications for which will be outlined subsequently.

The distributing valves for nitrous oxid and oxygen are similar to each other. Each is perforated by a square hole which is a continuation of the square gas channel leading from each of the supply bags to the mixing chamber above. The channel is square so that the dial of the distributing valves may be divided into twenty equal divisions between the open and closed points, that each division may represent one-twentieth or five per cent of the total area of the openings, and, therefore, other conditions being uniform, each division represents one-twentieth, or five per cent of the capacity of the valve to allow gas to pass from the supply bags to the mixing chamber. Before reaching

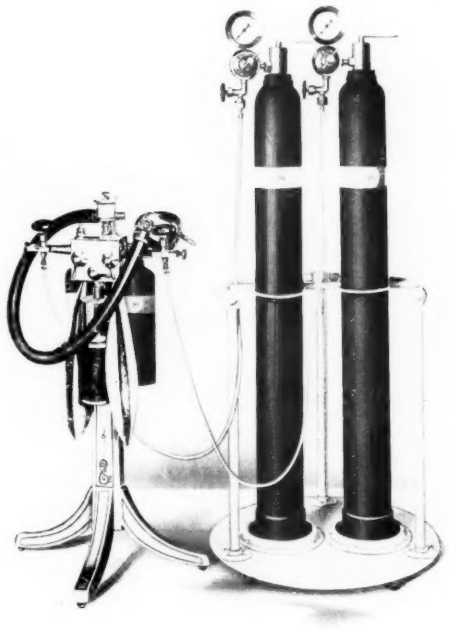


Fig. 1. This represents the apparatus connected to the oxygen and nitrous oxid drums containing 750 and 3,200 gallons of gas respectively, and a small tank each of oxygen and nitrous oxid which may be turned on while the drums are being replaced, or when it is desired to use the apparatus in the home.

the mixing chamber the gas must raise the two shaft or check valves. These valves prevent exhaled gases from entering the supply bags, which, if it occurred, would destroy our knowledge of the character of gas in these bags. The two valves are attached to the same shaft so that they must open simultaneously and to the same extent. If the valves were free from each other the oxygen valve under which only ten to twenty per cent of the gas passes, would very frequently fail to open and cyanosis would develop. The ideal is to obtain a uniform mixture of nitrous oxid and oxygen for each inspiration so that a uniform anæsthesia may be maintained. The rebreathing bag, whose function has already been mentioned, consists of a large cylindrical tube attached at the top through the rebreathing valve to the mixing chamber. A sliding collar is made to fit gas tight around the tube, to which is attached a thin rubber bag closed at the bottom. Over the bag and also fastened to the collar is a wire cage which prevents the expansion of the bag beyond its normal diameter. The tube is graduated from 100 cc. to 800 cc., which represents the capacity of the bag when the collar is pushed up or down to positions opposite these figures.

A small closed tube projects into the radiator chamber from the rear which receives a small electric lamp. The tube is provided with ridges extending into the radiator chamber, so that the heat from the electric lamp may bring the gas to a temperature of about 118° F., reaching the air passages of the patient at about body temperature.

An ether dropping cup is attached to the apparatus so that ether may be dropped into the radiator chamber if needed to intensify anæsthesia in refractory cases.

The mask consists of an aluminum body or tube, a celluloid face form, and an inflated rubber cushion. The aluminum body is provided with a flat valve, so guarded that the exhaled gases cannot be blown toward the field of operation, but leaves the mask perpendicular to the face. This valve is provided with an adjustable spring so that the mask may be put in any position and not interfere with its use.

The top of the mixing chamber is covered with plate glass so that the moving parts may be seen.

SUMMARY OF NEW FEATURES

1. Three separate bags, one each for oxygen, nitrous oxid, and rebreathed gases.
2. Adjustable graduated rebreathing bag by which the volume of gas breathed at each respiration may be measured, and by which any measured portion of this gas may be rebreathed at the following respiration. The surplus gas leaving the lungs after the bag is filled automatically escapes into the atmosphere carrying with it the higher percentage of carbon dioxide.
3. Graduated distributing valves, each graduation representing five per cent of the capacity of the valve.
4. Check valves attached to the same shaft, which insures the simultaneous opening of both the nitrous oxid and oxygen channels at each inspiration, and preventing contamination of the gas in the supply bags with breathed gas on exhalation. By these valves the mixture of gases is kept uniform.
5. A light transparent face piece, provided with a guarded valve so that the exhaled gas does not blow toward the field of operation.
6. Artificial respiration, by inflating the lungs with pure oxygen, may be immediately and effectually performed without first emptying or filling a bag.
7. A simple, compact gas warming device.
8. All moving parts are visible.

FUNDAMENTAL PRINCIPLES OF GAS ADMINISTRATION

Before proceeding to the method of administration, a few of the fundamental principles underlying the use of nitrous oxid and oxygen with this apparatus should be reviewed.

Normally nitrous oxid and oxygen, when administered pure without air or oxygen, produces anæsthesia in about 45 to 60 seconds, after which cyanosis, muscular twitching, vomiting, elevated blood pressure, slowing of the pulse, come on in rapid succession, and if the gas is still pushed,

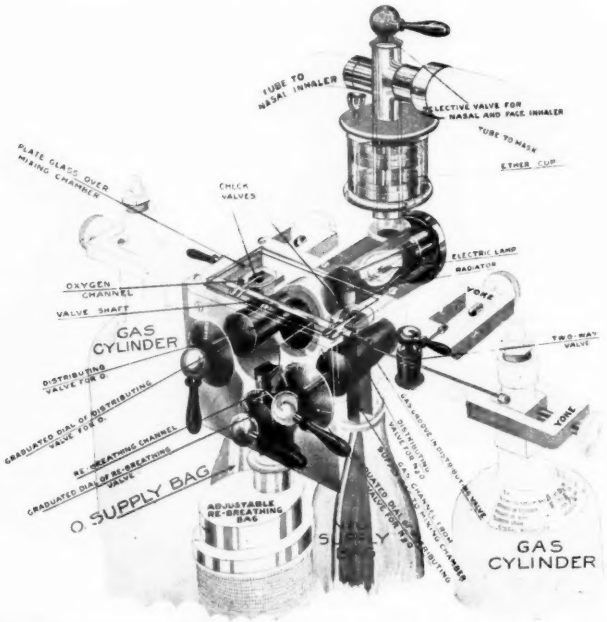


Fig. 2. An X-ray view of the apparatus proper, showing gas channels leading from the gas tanks to the supply bags, square gas channels passing through the graduated distributing valves, and ending under the check valves in the mixing chamber. The upper portion of the rebreathing bag with wire cage is shown below. The tube receiving the electric lamp from the rear, which acts as a radiator, is shown just below the ether cup. The large rubber tube leaving the apparatus from the rear leads to the face piece (not illustrated).

spasm of the respiratory muscles takes place. If, at the time anæsthesia begins, a sufficient supply of pure oxygen is inhaled with the nitrous oxid, anæsthesia continues without the development of symptoms of asphyxia, and the administration may be continued for hours if desired. Under these conditions the heart rate is about 20 to 40 beats above normal; respiration 30 to 40, and blood pressure elevated usually with the pulse and respiration about 10 mm. of mercury. If the oxygen is not administered in sufficient quantity per minute, the patient will gradually become blue or vomit, as the first symptom, followed by deeper cyanosis, labored respiration, becoming shallow, and finally apnœa from spasm of the respiratory muscles. An excess of oxygen administered with nitrous oxid produces no untoward symptoms in itself, but dilutes the nitrous oxid to a point at which anæsthesia is superficial, or altogether absent. As a rule oxygen cannot be used in larger amounts than 20 per cent without resulting in superficial anæsthesia and muscular rigidity. But a smaller amount than this is sufficient to maintain a pink color of the most dependent ear or finger nail, and more than this amount of oxygen is useless, unless the patient is very susceptible to the anæsthetic, which is exceedingly rare.

At each respiration, a certain amount of gas which remains in the large air passages at the end of inhalation, does not participate in the exchange of gases. Howell, in his Text Book of Physiology, page 602, says: "The actual amount of ventilation effected depends on the capacity of the bronchial tree, sometimes known as the 'dead space' of the lungs, since the air filling this space *is not useful* in the respiratory processes. According to observations founded partly on measurements of the casts of the tree, and partly upon physiological determination made by breathing air poor in oxygen, it would seem that this volume may be recorded at 140 cc." So at each respiration 140 cc. of air or gas is inhaled and exhaled which is entirely wasted. Under nitrous oxid and oxygen anæsthesia with a respiratory rate of thirty per minute (probably near the average) this waste amounts to 73 gallons per hour, unless the patient rebreathes the gas.

Rebreathing nitrous oxid and oxygen has received considerable attention recently. Willis D. Gatch, of Baltimore, in an article on nitrous oxid and oxygen anæsthesia by the method of rebreathing (J. A. M. A. March 5, 1910) recommends the method after a thorough trial in 700 cases. He permits his patients to breathe to and fro from an eight liter bag full of nitrous oxid and oxygen for two or three minute intervals, or longer, before renewing the gas in the bag. In this way, not only does the patient save the 140 cc. contained in the bronchial tree, but also that which comes from the alveoli containing carbon dioxide. As respiration goes on, the CO_2 content of the gas in the bag becomes progressively higher at each exhalation until it is replaced by a new supply, when the process is repeated.

With the apparatus here described, when the rebreathing method is used, a portion of each exhalation is stored in the rebreathing bag, and the remainder escapes into the atmosphere. As much fresh gas is inhaled at the next breath as escaped before, so a constant controllable amount of rebreathing is possible, and without having to think about changing the gas. The process is entirely automatic and may be stopped by turning off the rebreathing valve.

The value of preventing excessive loss of CO_2 through rapid breathing has been emphasized during the last 3 or 4 years in a series of experiments performed by Yandell Henderson[1] and associates. His conclusions, if borne out in clinical practice, are of great practical importance to the surgeon and anæsthetist, whether chloroform, ether, or nitrous oxid and oxygen is used as the anæsthetic.

Some of the points brought out, or emphasized by his work are:

1. That carbon-dioxide is the normal stimulant of the respiratory and cardio-vascular centers.

2. That the respiratory center is more sensitive to CO_2 than the cardio-vascular center.

3. That CO_2 is the normal stimulant of the venous wall causing contraction.

4. That excessive artificial respiration applied to dogs for 25 to 30 minutes, is followed by apnœa (suspended respiration) so prolonged that the heart fails, after seven or eight minutes, for lack of oxygen. The inactivity of the respiratory center is solely due to the depletion of the body's store of CO_2.

5. That administration of CO_2 gas during apnœa as a result of over-ventilation induces an immediate return of natural breathing.

6. That the administration of oxygen by the Volhard method affords ideal conditions for recovery from acapnia (diminished CO_2 in the blood and tissues from rapid breathing).

7. That the fall of blood pressure in surgical shock is due principally to the loss of venous tonus (as opposed to the more generally accepted theory of lost arterial tonus).

8. That relaxation of the venous system interferes with the normal filling of the heart with blood, hence, the output per minute is less in spite of the increased rate, and the arterial pressure falls.

9. That voluntarily forced breathing in man, so far as the experiment can be safely carried, induces symptoms similar to those of shock. Death from failure of respiration would probably result from vigorous voluntary hyperpnœa for 15 or 20 minutes.

In short, Henderson is able to control the pulse and blood pressure in the dog by conserving the loss of CO_2 during rapid artificial breathing, or, is able to produce surgical shock, so called, by an excessive waste of CO_2.

[1] The American Journal of Physiology, vol. XXI, No. 1; XXIII, No. 5; XXIV, No. 1; XXV, No. 6; XXV, No. 5; XXVI, No. 3.

ADMINISTRATION

The patient's preparation should be the same as for any other anæsthetization if possible. In adults one-half to one hour before operation a hypodermic of morphine 1/8 grain to 1/4 grain, and atropine $\frac{1}{150}$ grain or, in nervous persons, hyoscine $\frac{1}{100}$ grain may be administered. This, however, should not be a standing order, but the physical condition, temperament, etc., of each patient should be reviewed before the order is given. With no contraindication the hypodermic should be given in oversized or very muscular patients and in alcoholics, and is desirable except in children or poorly nourished adults.

The apparatus should be ready for use before the patient is brought to the operating room. The bags filled with gas and the valves leading from the nitrous oxid supply bag to the inhaler wide open. Other valves should be closed. Thus prepared the patient is placed on the table in a comfortable position and the mask adjusted to the face, while the expiratory valve is held open so that the patient may become accustomed to breathing through the mask. The expiratory valve is then quietly released during exhalation and a steady stream of gas sufficient to maintain the supply bags at about the two-thirds full condition is established while the patient is breathing the nitrous oxid. No oxygen is given until the air is washed out of the lungs and apparatus by ten to fifteen respirations; but before anæsthesia

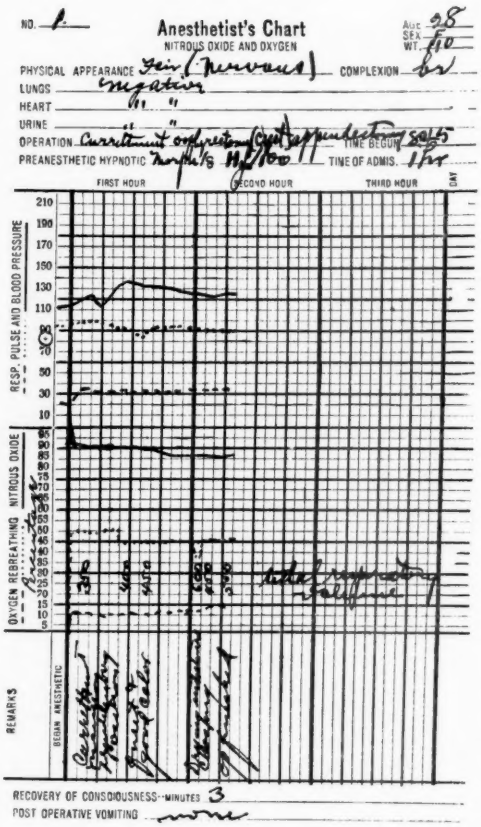


Chart 1 illustrates the condition of the pulse, respiration and blood pressure, before and during an operation lasting one hour and twenty minutes. Curettement of the uterus, oöphorectomy for a medium sized ovarian cyst and appendectomy was done.

Nitrous oxid and oxygen with rebreathing was used. At the end of 25 minutes with a tidal respiratory volume of 400 cc. and rebreathing 50 per cent or 200 cc., the blood pressure had risen to 135 when rebreathing was diminished, and the blood pressure very gradually fell 10 mm. of mercury. This is a typical tracing for nitrous oxid and oxygen with rebreathing.

is established, or cyanosis and jactitation appears, the oxygen valve is opened to the five or ten per cent position, and if rebreathing is to be used the rebreathing valve is then opened wide and the rebreathing bag set at about 200 cc., or about half the tidal respiration volume, until anæsthesia is established. The oxygen should be increased gradually if the most dependent ear, or finger nail, shows any development of cyanosis. The normal color to be maintained in this form of anæsthesia is a dark pink (but not blue).

With respiration regular and anæsthesia properly established the tidal respiratory volume should then be determined by sliding the rebreathing bag down until the bag is just filled and emptied at each respiration (the figures on the tube opposite the collar represent the capacity of the bag in cubic centimeters), and then readjusted so that the bag will hold from 50 to 75 per cent of the volume of tidal respiration. At each respiration then fresh gas is taken from the supply bags and 50 to 75 per cent is exhaled into the large rubber tube to be rebreathed at the next inhalation.

If the case is one of extremely bad prognosis and likely to develop failure of respiration just after anæsthesia is established, or upon evacuation of some cavity, the anæsthetist should be ready to keep up artificial respiration if required until breathing is re-established by allowing pure oxygen to inflate the lungs and escape slowly. This is done by turning the oxygen distributing valve around to P, closing the nitrous oxid valve and holding the mask tightly to the face, while a stream of oxygen inflates the lungs. The oxygen tank is then turned off, the mask raised while the lungs deflate, and the process repeated. In this way artificial respiration should be carried on slowly and deliberately about ten times per minute. It is efficient with any chest no matter how rigid with age.

If possible, the pulse, respiration, and blood pressure, should be taken before and every five minutes during the administration. The first determination made after the patient is properly anæsthetized is generally the standard of pulse, blood pressure, and respiration, which should be maintained, unless there has been abnormal influences, such as severe toxæmia, Graves' disease, hæmorrhage, etc., to change their proper relations. In a few minutes after the initial rise of pulse, respiration, and blood pressure, if it is found that the blood pressure continues to rise sharply, with increased depth of respiration and a fall in pulse rate, we conclude that too much carbon dioxide is administered, even though the color is being maintained with an adequate supply of oxygen. The rebreathing bag should then be decreased in capacity. On the other hand, if the blood pressure is falling and the pulse and respiration becoming more rapid and smaller in volume (indicative of beginning shock)—several of our recent cases in which an effort was made to control this condition, showed a return approaching closely the

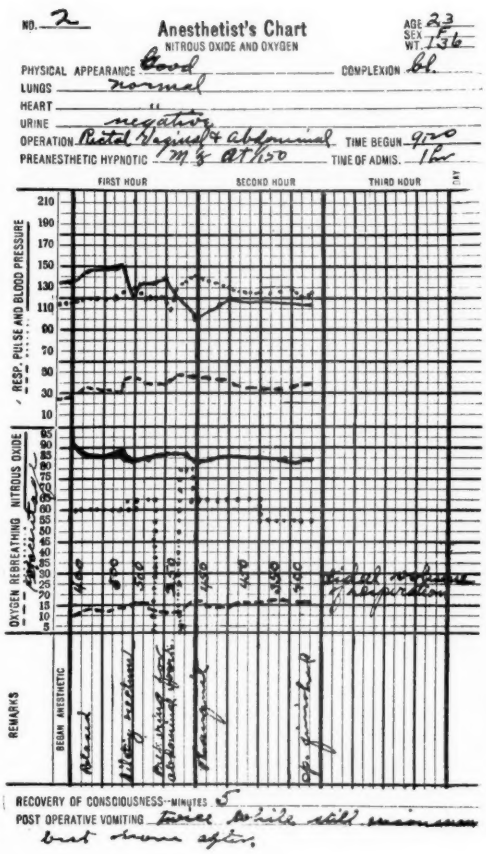


Chart 2 illustrates the influence of rebreathing nitrous oxid and oxygen in various amounts. The operation was for hæmorrhoids, laceration of perineum, and pelvic work through the abdomen. After the rectal and vaginal work was finished, and while the patient was being prepared for abdominal section, 40 to 50 minutes after beginning the anæsthetic, rebreathing was not permitted, shown by the lower dotted line; five minutes after, the blood pressure began to fall, as illustrated by the upper solid line; the pulse rate increased slightly, as seen by the dotted line, and the volume of respiration in cubic centimeters marked in figures below, was greatly decreased. With 80 per cent rebreathing for six or seven minutes, followed by 60 per cent for half an hour, the blood pressure rose 15 mm. to 20 mm. of mercury and the pulse rate slowed 15 beats per minute.

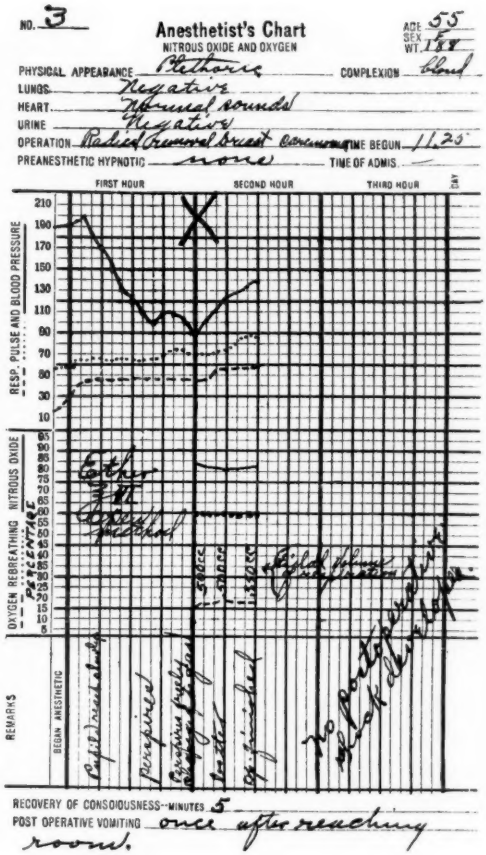


Chart 3 illustrates a case of a large woman during a radical operation for carcinoma of the right breast. The first hour of the operation was done under ether. At X, after a marked fall in blood pressure nitrous oxid and oxygen with rebreathing was substituted, because of the danger of the development of shock of a more severe type. The improvement of the condition began almost immediately and continued to the end of the operation. The patient was conscious in five minutes after the mask was removed, vomited but once, and had an uneventful recovery.

former conditions, or the standard for the case,—when the amount of rebreathing was increased.

In this way the anæsthetist should be able to check the development of surgical shock associated with rapid breathing and excessive loss of CO_2.

CONTRAINDICATIONS TO REBREATHING

1. A maintained tidal respiratory volume of less than 300 cc. associated with a respiratory rate below thirty per minute during anæsthesia.

2. Very high blood pressure with arterial disease. After the blood pressure begins to fall,

however, rebreathing may be used to a moderate degree.

CLINICAL RESULTS

We have been using nitrous oxid and oxygen anæsthesia for the past five years for both major and minor operations.

With the apparatus here described we have administered nitrous oxid and oxygen during the past eight months for over one hundred major operations, besides a number of minor operations. In these cases are represented nearly the whole list of major operative procedure. Among the operations were appendectomy, hysterectomy, and other less radical intra-abdominal operations on the female organs; gastro-enterostomy, perineal and suprapubic prostatectomy; operations on the gall-bladder and ducts, intestinal suturing of perforations, Cæsarean section with and without eclampsia; ruptured ectopic gestation, strangulated and simple hernia, and extensive operations on the breast, kidneys, etc.

Among the less radical operations, but from the standpoint of the anæsthetist, more dangerous procedures, this anæsthetic was used with great satisfaction for the resection of ribs and drainage of empyema, circumcision, hæmorrhoidectomy, vaginal and perineal repair work, curettement, amputations, excision of the eyeball, intra-oral operations, etc.

The time of anæsthesia varied from a few minutes to over three hours, and the ages ranged from a baby thirty-one days old for circumcision to a lady eighty-nine for strangulated hernia.

The pulse, respiration, and blood pressure has been taken as a routine before and at frequent intervals during the administration. With the data thus acquired we have been able to demonstrate uniformly better results on the table with gas and oxygen than with ether or chloroform which have had the same routine investigation. In a few cases, such as is illustrated by chart No. 3, when surgical shock was threatening with the use of ether, we have changed to nitrous oxid and oxygen with marked improvement within fifteen minutes in each case. Several cases have been successfully operated which, if ether had been our last choice would not have been undertaken. The patients who have had previous experience in taking ether or chloroform recommended gas and oxygen to their friends as the only anæsthetic they would care to take again, because they avoided the after vomiting, the unpleasant odor, and the prolonged stage of recovery and abstinence of water. We have had four per cent of nausea and vomiting after the patient was sufficiently recovered to remember, and nearly half vomited just after the mask was removed without being conscious of it. Of the four per cent, one gave a history of vomiting easily.

The cost of the gas per hour depends upon the size of drums or tanks in which it is purchased. The average case, by the method described, will use per hour one hundred gallons of nitrous oxid and fifteen gallons oxygen. The cheapest way to produce nitrous oxid is by a private generating plant from which gas may be obtained at from sixty to seventy-five cents per one hundred gallons, but the cost of installation is considerable. The next best, from the standpoint of cost, is the large 1,200 to 3,000 gallon drums, illustrated in Fig. 1, in which gas may be obtained at from $1.25 to $1.50 per hundred gallons. The gas in these drums is of better quality than that usually produced in small private generating plants, and may be easily taken from one operating room to another. In small cylinders gas costs $2.00 per hundred gallons. The oxygen costs from $5.00 to $2.25 per hundred gallons depending upon the size of the container.

CONCLUSIONS

1. With the method described the development of surgical shock due to over ventilation of the blood may be prevented, and when shock (not due to hæmorrhage) has developed it may, in many cases at least, be relieved by the use of nitrous oxid and oxygen with a definite amount of rebreathing.

2. The amount of rebreathing to be permitted is governed in all cases by the volume of respiration, the blood pressure, and the pulse.

3. Nitrous oxid and oxygen may be successfully administered for any operation mentioned above.

4. It is the safest anæsthetic to be used when the case is complicated with pneumonia, tuberculosis, nephritis, or severe toxæmia.

5. Uniform mixture of gases at each respiration is essential to success.

TRANSACTIONS OF SOCIETIES

WASHINGTON SURGICAL SOCIETY

SECOND REGULAR MEETING OF THE WASHINGTON SURGICAL SOCIETY HELD APRIL 20, 1911

CLINICAL REPORTS AND PATHOLOGICAL SPECIMENS

Dr. James Mitchell presented portions of an *unusually large saphenous vein* removed from a woman twenty-four years of age. While making the routine physical examination of this case, a large abdominal tumor was discovered which had caused no symptoms of any kind. The mass seemed to be a left ovarian cyst. At operation a very large retroperitoneal cyst was found filling the pelvis and extending up under the diaphragm. The pelvic organs were normal. The left ureter was firmly attached, but after considerable dissection and the tapping of the contents, the cyst was removed. Dr. Mitchell exhibited the cyst, which showed areas of degeneration infiltrated with lime salts. He had been unable to determine the origin of the cyst. In discussion, Dr. Bovée said the origin might have been in an aberrent ureter, or a diverticulum of the ureter, or in the Wolffian duct, but that in this case the character of the fluid suggested an origin in a supernumerary ovary. In removing such growths he suggested making a large incision rather than tapping.

Dr. Mitchell also reported a case of *intestinal perforation* in a man of 74 who had a *right inguinal hernia* for many years. He had accidentally struck the pad of his truss against a porch, causing considerable pain. At first there were no very suggestive symptoms. He vomited once soon after the accident; a few hours later the temperature was 99° and there was slight distension; two enemas were given and retained. At operation next morning, a hole in the small intestine was discovered large enough to admit the thumb. The blow on the truss pad had evidently pinched a hole in the intestine. In discussion, Dr. Stone questioned the use of enemas in such a case, but Drs. Carr and Mitchell thought as a rule the giving of an enema in these cases would be safe and conservative practice, especially in the absence of definite symptoms of perforation.

Dr. A. A. Snyder reported a case of a man three weeks convalescent from an operation for rectal abscess, who after eating a very heavy meal developed symptoms of shock and collapse and died. The only postmortem finding of interest was a large *dilated stomach* filled with food.

Dr. William P. Carr read the paper of the evening entitled "Saving the Hundredth Man" which is published in this number. (See page 434.)

Dr. H. D. Fry, in opening the discussion, thought much could be done by avoiding unnecessary handling and pinching of hæmostats and by the skillful administration of the proper anæsthetic with a view to lessening the duration of anæsthesia as much as possible. He was sure the use of rubber gloves is advisable in protecting both the surgeon and the patient.

Dr. E. A. Balloch said the use of gloves is undoubtedly a safeguard and especially advisable for assistants and nurses; but little delicacy of touch is lost and the eye is now depended upon largely to the exclusion of touch. He emphasized the necessity of rapid and dry operating, and mentioned the greater percentage of aseptic recoveries in hernias operated on in recent years by Coley.

Dr. Hooe spoke of the necessity of knowing one's patient and of securing the confidence necessary to lessen psychic shock. Dr. White mentioned the necessity of lessening shock by every means possible and urged the necessity of closely watching patients recently operated on.

Dr. Bovée had used gloves since 1898 and could see no possible reason for any one to revert to the old order of things. Any suggestion to the contrary seemed to him largely academic.

Dr. Vaughan said he used gloves as much for his own convenience as anything, and in some respects was rather inclined to agree with Dr. Carr. Everything depends on the thoroughness with which the process of hand disinfection is carried out.

Dr. Carr, in closing, said he did not believe his results would have been improved by the use of gloves; the only case he ever had die of infection pure and simple was an epithelioma of the breast operated on ten years ago. Since he had stopped the prolonged scrubbing of wound areas there had been fewer stitch abscesses, and in recent years he had had very few wound infections.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF SURGERY

UNDER THE CHARGE OF

FREDERIC A. BESLEY, M. D.

GEORGE E. BEILBY, M. D.
J. S. EISENSTAEDT, M. D.
FRED C. ZAPFFE, M. D.
ARTHUR B. EUSTACE, M. D.
WM. R. CUBBINS, M. D.
FREDERICK G. DYAS, M. D.
JAMES F. CHURCHILL, M. D.
JOHN A. WOLFER, M. D.
AIMÉ PAUL HEINECK, M. D.
G. T. COURTENAY, M. D.
B. J. O'NEILL, M. D.
H. A. POTTS, M. D.

Acute Dilatation of the Stomach (Über die akute Magenerweiterung). HARUZO KURU. *Mitteil a. d. Grenzgebiet. d. Med. u. Chir.*, bd. xxiii, h. 2.

The author discusses the etiology of this not infrequent affection as given by Rokitanski (pressure upon the duodenum by the mesentery of the small intestine), as Stirda pointed out that the condition was primary in the stomach, also that the enormous dilatation is secondary to an intestinal obstruction and is increased by a valve-like action of the cardia. Two groups of the primary type are discussed; one upon a purely nervous basis, the other due to direct injury to the stomach, be it mechanical or from the anæsthetic, especially in patients of low vitality. In the report of cases fermentation of stomach contents is ruled out. Four operated cases were closely observed and statistics from 15 cases given. Autopsy showed pathological processes in the adrenal glands.

The author concludes that acute dilatation of the stomach may be spontaneous or postoperative and as etiological factors he gives:

1. Paralysis of the stomach due to: (a) Direct injury to the stomach. (b) Reflex from distant irritation.

2. Injury to the nerves (combined with cardiac disturbance): (a) Auto-intoxication. (b) Lack of a *stomach and heart regulating substance*, viz., the products of the adrenal glands.

3. Intestinal obstruction causing paralysis of the stomach: (a) Tampon in the pyloric region. (b) Volvulus or pressure of mesentery. (c) Valve-like action of cardia.

In support of the lack-of-adrenal-product theory, he offers in explanation the fact that in Addison's disease even without pigmentation we see excessive vomiting, loss of appetite, and other stomach symptoms, with increase of pulse rate, low blood pressure, and cardiac disturbance — all of which are common to both conditions. The author points out the importance of early diagnosis of acute dilatation and in addition to the ordinary treatment, the use of adrenalin. H. A. POTTS.

Remarks Concerning the Paper of Haruzo Kuru on Acute Dilatation of the Stomach (Bemerkung zum Aufsatze von Haruzo Kuru "Über akute Magenerweiterung"). B. NAUNYN. *Mitteil. a. d. Grenzgebiet. d. Med. u. Chirur.*, bd. xxiii, h. 2.

"In the present-day discussion of acute dilatation of the stomach I do not find fermentation of stomach contents mentioned as a causative agent. I desire to point out that in my article 'Über das Verhältnis der Magengärungen zur Mechanischen Mageninsuffizienz' (Deutsche Archiv fur klinische Medizin, 1883) and in the article by Minkowski (Mitteil. aus der Königsburger medizinischen Klinik, 1888), also in the article by Ehret in this journal, bd. iii) it is clearly shown that acute dilatation of the stomach *does* result from fermentation of gastric contents. Also that the cure of that condition is mentioned by us." H. A. POTTS.

Microscopic Examination of the Bile for Diagnostic Purposes (Mikroskopische Untersuchung der Galle zu diagnostischen Zwecken). EUGENE PETRY. *Wien. klin. Wchnschr.*, 1911, xxiv, 927.

Petry used Boldyreff's method for obtaining the bile. This consisted in giving 200 gms. of olive oil on an empty stomach, which produces a reflex flow of bile through the pylorus. The whole was then removed by means of the stomach tube after half to three-quarters of an hour. In a case of cholecystitis he found bile-stained leucocytes; this he thinks is not necessarily characteristic of the condition. In several cases of gall-stones, however, crystals and fragments of the stones were present in the fluid. These cases were confirmed by an operation. In order to determine whether the secretion was changed in cases of disturbance of the liver, he fed phosphorus and oil to rabbits and in these he found liver cells containing globules and showing other signs of degeneration.

Leucin and tyrosin crystals were not found. The cells corresponded to those found in the liver of these animals.

In two cases of cirrhosis of the liver he was unable to obtain any bile whatever.

Pneumococcus Peritonitis, with Report of a Case. HARVEY B. STONE. *Bulletin of the Johns Hopkins Hospital*, vol. xxii, p. 219, July, 1911.

The author believes that this condition presents a fairly well defined symptom-complex which should be better known and more generally recognized than is the case at present. Although not one of the exceedingly rare diseases, it is still sufficiently unknown to deserve reporting. These are the reasons which led the author to the presentation of this paper which he has reinforced by certain features of a case of unusual interest which came under his observation. Briefly, the facts of his case are as follows: The patient was a female five years of age who had had pneumonia two years previous, complicated by acute otitis media. After recovering from the pneumonia, the otitis persisted and became chronic. The onset of the peritonitis was sudden and very typical of acute peritoneal inflammation. At the operation there was a large amount of thick, greenish yellow pus, free in the peritoneal cavity. It was noted that the pus was odorless. No lesions accountable for the infection could be found. Cultures were made and the pneumococcus isolated. For a short time after the operation the patient seemed to rally but the evening of the day of the operation her temperature rose steadily and she became delirious and died the next day with all the symptoms of a profound intoxication.

The author discusses the condition from various standpoints and he summarizes his article as follows: Pneumococcus peritonitis occurs more often in children than in adults and more often in female than in male children. There are two forms, the encapsulated, which exhibits a first period of invasion, a second period of localized abscess formation, and a third of spontaneous rupture of the abscess; and the diffuse form of general peritonitis, rapidly fatal unless operated upon. The symptoms of onset in both forms, varying only in intensity, are abdominal pain, vomiting, fever, and diarrhœa. Rigidity is not characteristic. The treatment is surgical intervention as soon as possible. The prognosis of the diffuse form is very bad; of the localized form, fairly good. The pus is characteristic and often sufficient for diagnosis from its macroscopic appearance alone.

GEORGE E. BEILBY.

The Recognition in Radiograms of the Renal Pelvis and Ureters after Inflation with Oxygen (Darstellung des Nierenbeckens und Ureters in Röntgenbilde nach Sauerstoffüllung). A. v. LICHTENBERG AND H. DIETLEN. *Münch. med. Wochen.*, No. 25, 1911.

The authors report three cases to date in which an unusually marked contrast picture was obtained by inflating the renal pelvis and ureters with oxygen, and recommend this technique as a very helpful and easily carried out, harmless diagnostic aid.

J. S. EISENSTAEDT.

Remarks on Förster's Operation (Beiträge zur Försterschen Operation). GEORGE STIEFLER. *Wien. klin. Wchnschr.*, 1911, xxiv, 1151.

Two cases are recorded. The first a case of spastic diplegia in a boy twelve years old. This was a case of Little's disease of a severe type. The boy was able to walk some after the operation, and spastic condition of the muscles had almost disappeared. The second, third, and fifth lumbar and the second sacral spinal ganglia on each side were removed. The second case was one of the tabes dorsalis with very severe disturbances of sensation in the form of hyperæsthetic zone on the thorax and neuralgic pains. In this case the second to the sixth dorsal ganglia were removed and the relief was absolute.

Studies upon Metaplasia of Papilloma of the Bladder into Carcinoma (Über Metaplasie von Blasenpapillomen Karzinom). RICHARD SYRING. *Beiträge zur klinischen Chirurgie*, bd. lxxiii, h. 1.

In connection with forty-two cases collected from the literature of reported metaplasia Syring will only admit such occurrence when the tumor remains unchanged and in the same location for at least six years, as controlled by cystoscopic examination, and when after the lapse of six years the papillary tumor has proven itself both clinically and histologically malignant. He believes that papillomata of the bladder are partly benign tumors and partly malignant carcinomata, and that a thorough histological examination will prove that the malignant variety predominates. Macroscopic and histologic examinations do not permit one to form an absolute judgment, unless the entire tumor, pedicle, and basis is removed, and serial sections made. Then only can malignancy be ruled out. Even those histologically definitely proven benign papillomata must be considered more or less malignant, on account of hæmorrhages, tendency to cystitis, and possibility of recurrence (carcinoma). Cases of metaplasia, however rare, do occur. He believes that a total extirpation of the bladder and the creation of a new one, will be undertaken in the future in those cases of papilloma which conduct themselves as malignant tumors even without definitely proven carcinomatous structure.

J. S. EISENSTAEDT.

Acute Cholecystitis with Large Amounts of Calcium Soap in the Gall-bladder. JOHN W. CHURCHMAN. *Bulletin of the Johns Hopkins Hospital*, vol. xxii, p. 223, July, 1911.

In view of the great frequency with which the gall-bladder is drained in conditions identical with those present in the patient whose case Churchman reports, the absence of any similar case in the clinical literature emphasizes the uniqueness of the observations which are here recorded. Although soaps are found in small amounts in the bile, the author states that he has been able to find no records in the chemical literature on the subject of a gall-

bladder contents composed almost entirely of soap. The clinical features of his case were typical of an acute cholecystitis. The patient had never had typhoid fever. At the operation straw colored fluid was found in the peritoneal cavity, cultures from which remain sterile. The gall-bladder was distended and much inflamed and on aspirating the organ, instead of containing pus, a fluid, unlike anything that the author had previously seen in the gall-bladder, appeared in the barrel of the syringe. The color of the material suggested a mixture of cod liver oil and turpentine and resembled the contents of a mesenteric cyst which he had observed. On opening the gall-bladder a number of bile stained stones were found and removed. There was neither bile nor pus in the gall-bladder. The chemical analysis of the material from the gall-bladder showed it to consist largely of soaps of the calcium salts. Some free fatty acids were also present but no bile pigments. Churchman states that the analyses of other investigators, although the figures have shown some differences, agree as to the substances found and in a way as to their relative proportion. All observers have found a small amount of fatty bodies (fatty acids, soaps, fats, and lecithin) but none have found them in such preponderance as was the case in this patient.

GEORGE E. BEILBY.

A Synopsis of Studies on Peritoneal Adhesions, with a Contribution to the Treatment of Denuded Bowel Surfaces. EDWARD H. RICHARDSON. *Bulletin of the Johns Hopkins Hospital*, vol. xxii, p. 283, Aug., 1911.

Impressed by several striking instances which had come under the observation of the author, during the past few years, of the frequency and seriousness of postoperative peritoneal adhesions, he was led recently to undertake a systematic study of the entire available literature upon this subject in order, if possible, to arrive at some definite conclusions regarding the pathology, the etiology, the prevention, and the treatment of peritoneal adhesions. In this communication he also presents a brief synopsis of his work in connection with the description of a new method of treating denuded bowel surfaces. The literature on the subject is thoroughly reviewed and the subject discussed from its various phases, and then he describes briefly his new method. This consists in dividing one leaflet of the mesenteric peritoneum along its line of attachment to the bowel and adjacent to the raw areas on the surface of the latter and after gently dissecting this leaflet of peritoneum it is brought over the denuded area and firmly fixed by interrupted sutures of fine silk. The author is thoroughly convinced that the proper selection of cases, the use of mesenteric peritoneum for covering raw bowel surfaces possesses distinct advantages over all other methods hitherto proposed.

GEORGE E. BEILBY.

Passage of Bacteria through the Intestinal Wall. MAZYCK P. RAVENEL AND B. W. HAMMER. *Journal of Medical Research*, vol. xxiv, p. 513, June, 1911.

This experimental work was undertaken by the authors particularly to study the passage of the organisms into the blood as well as to give further evidence on antiperistalsis. The technique was carried out with the utmost care. The bacillus prodigiosus was used as the test organism. It was grown 48 hours on agar slants, then suspended in normal salt solution in which the growth was thoroughly broken up and distributed, the larger masses being allowed to settle out before use. The amount of material used in ten rabbits was from 4½ to 5 centimeters containing the growth of four agar slants. The injections were made with a soft rubber catheter which was passed two inches into the rectum. The shortest time which elapsed between the injections and the making of the cultures was 1 hour and 20 minutes, and the longest time, 5 hours and 20 minutes. Cultures were made from the stomach, large intestine, small intestine, cecum, blood, and rectum. In no case was the bacillus prodigiosus recovered from the stomach, large intestine, small intestine, cecum, or blood. In two cases it was recovered from the rectum.

The two conclusions which the authors feel justified in drawing from this work are: (1) that antiperistalsis will not, as a rule, carry bacteria above the ileo-cecal valve and second, that the passage of bacteria into the blood from the rectum does not occur rapidly nor surely. GEORGE E. BEILBY.

Chronic Universal Diverticulitis (Les diverticulites chroniques d'emblee). F. LEJARS. *Sem. Med.*, 1911, xxxi, 277.

Lejars describes four cases of inflammation of Meckel's diverticulum which manifested themselves by attacks exactly simulating appendicitis, the character of the trouble being manifested only at the time of operation.

CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

ALBERT J. OCHSNER, M. D., President
JOHN G. CLARK, M. D., Vice-President
FRANKLIN H. MARTIN, M. D., General Secretary
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Second Annual Meeting, Philadelphia, November 7 to 16, 1911

PHILADELPHIA COMMITTEE ON ARRANGEMENTS

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JOHN B. ROBERTS, M. D.

A WELCOME TO THE MEMBERS OF THE CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

TRANSMITTED ON BEHALF OF THE PHILADELPHIA COMMITTEE ON ARRANGEMENTS

BY JOHN G. CLARK, M. D., CHAIRMAN

In recent years the visual rather than the didactic method has assumed a place of paramount importance in the teaching of surgery. While the ever widening scope of our local, state and national societies has given splendid opportunities for the exploitation of new ideas and theories and the recording of instructive cases, nevertheless there is a wide hiatus between a written or an oral description of a method or principle and its practical demonstration in a clinic or laboratory. In former days the education of an European medical student was not complete without his "Wanderjahr," during which he passed from one medical center to another or concentrated his energies in some famous clinic more or less distant from his natal school. This same plan was followed by artists and craftsmen, and this insatiable desire for all that was novel and best in his art frequently carried the wanderer into remote countries from whence he returned with fresh enthusiasm as the champion of a newer and better school. During the last decade this old custom has been generally revived, especially in the interchange of clinical visits among American surgeons. Such democracy of ideas is the parent of the greatest culture, for as the lapidary utilizes one stone to polish another, so this intermingling of physicians stimulates and brings out the best in each individual. Often a visiting investigator is first to discover the foreign prophet.

Thus in surgery the Listerian principle was transplanted across the channel into Germany and France and over the Atlantic into

America while yet in its swaddling clothes. Even years back of that era our medical forebears had been persistent seekers for new light, first in France, then in England, and of more recent years, in Germany and Austria.

With the increasing facilities for transmission of new ideas through our most efficient medical press, there has been a broad expansion of American surgery and medicine. This progressive tendency has generated an impelling "Wanderlust" in all of us. The ingenious and ever inventive American surgeon wishes to see his colleagues in their workshops, where by comparison and critical analysis he may supplement his deficiencies and properly inventory his own accomplishments.

We are, therefore, at a period in our medical history when no surgeon can count himself as a fully accredited member of our guild, even though he may possess the inherent skill of a genius, unless he has witnessed at close range the brilliant routine operations being performed in many hospitals on this side of the Atlantic Ocean. American surgery has, through its brilliant accomplishments, quite justly attained a most distinguished and unique place, and we cherish the thought that this science is carried into more perfect execution by a much larger ratio of skilled American and Canadian representatives than in any other country in the world. Throughout the great breadth and length of the United States and Canada, the highest type of surgery is being done.

This new Clinical Congress has therefore arisen at an opportune moment, to meet the very general desire among the surgeons of North America to secure at first hand the products of the splendid clinics and laboratories of these two countries.

The history of American surgery cannot be written without granting a generous space to the labors of such great pathfinders as Gross, Pancoast, Agnew, Ashhurst, Goodell, Keen, Price, White, and many other Philadelphians still in active service.

The splendid precepts of these masters have been transmitted to a large number of worthy successors, and the wealth of hospital and laboratory facilities in Philadelphia affords comprehensive opportunities for the development of new and the perfecting of old principles.

It is therefore with great pleasure that the surgeons of Philadelphia extend a most cordial invitation to the Clinical Congress of Surgeons of North America to hold its second session in this eastern city.

The scientific program has been so arranged that the days will be fully occupied with all that pertains to progressive surgery. That the social intermingling of our guests shall be amply facilitated, several evening entertainments have been arranged. It is the earnest desire of the surgeons of Philadelphia that this second session shall be a successful one, and to this end we shall throw open to you our medical schools, our hospitals, our clinical and research laboratories and our medical societies, and we hope that you may find your stay with us both pleasant and profitable.

AN APPRECIATION OF THE PHILADELPHIA SESSION OF THE CLINICAL CONGRESS

By JOHN B. MURPHY, M. D., Chicago, Illinois

THE coming meeting of the Clinical Congress of Surgeons of North America, to be held at Philadelphia, should be an epoch-making session in organized medical education for the benefit of the practitioner of medicine and surgery. Philadelphia has exceptional clinical advantages and an enormous amount of available clinical material, centrally located, and reasonably near to the large amphitheatres and clinic rooms. In addition, it has a body of able clinical teachers to present the subjects and operations in an attractive and instructive manner, so that the greatest benefits may be obtained by the visiting surgeons. The clinical diagnostic methods and surgical technique will be supported by the demonstration of a large number of pathologic specimens from the museums, so that a complete picture of the diseases considered can be given in each case.

The attendance will undoubtedly exceed that of last year, as this method of teaching practitioners is daily becoming more appreciated as it is more productive of good results than any other plan. Ten days of this work will give food for a year's thought and greatly stimulate the practitioner's interest in his work and enhance his value to his patients. It places him at once in advance of the journal and text-book information. It puts a live interest into his work by personal contact with the men who are making medical history and forcing medical advancements.

The professors will devote much more time to the principles involved in the diagnosis and operations than to the technique of the procedure. The latter can be easily acquired on animals and in the dead house, but true clinical inspiration can only be attained in the arena or at the bedside.

The large attendance and enthusiasm of the men attending the last meeting indicate that the society should at once place a definite restriction on the number of its membership, that the clinic rooms may not become too crowded at the annual sessions.

The secretary of the society, Dr. Franklin H. Martin, has so well arranged all of the details that a large number of visitors can be easily cared for to the best advantage. He deserves great credit for the judgment which he has exercised and the labor which he has performed in securing such good opportunities for work at the Congress.

Under the able and inspiring guidance of its President, Dr. Albert J. Ochsner, the meeting is sure to be a memorable one. The hospitality of the medical profession of Philadelphia is proverbially great. The profession of Philadelphia will exert every effort to make this meeting a pronounced scientific success.

ARRANGEMENTS FOR THE PHILADELPHIA MEETING IN DETAIL

THE PROGRAM

The scientific program of the Congress will consist of:

First — Clinics in surgery and allied subjects, including general surgery, gynecology, orthopedic, genito-urinary, eye, ear, nose and throat, and obstetric surgery; also special demonstrations in cystoscopy, bronchoscopy, esophagoscopy, stereo-radiography, rapid Röntgenology, vaccine therapy, surgical pathology, etc.

Second — A series of seven carefully prepared evening literary programs with appropriate demonstrations, illustrations, and discussions.

The clinics and special demonstrations will be conducted by the leading clinicians of Philadelphia in the principal hospitals with the co-operation of all the undergraduate and postgraduate medical schools of the city. They will be arranged in such a manner and in such numbers that a large body of visitors may be accommodated from early morning until evening each day of the session.

The participants in the evening programs will be the leading surgeons of America outside of Philadelphia, with discussions by local and visiting surgeons.

It is the desire of the Executive Committee to emphasize the scientific features of the meeting, eliminating as far as possible any social features that might detract therefrom.

REGISTRATION FEE

The constitution of the Congress does not provide for the payment of annual dues by the members, but does provide that a registration fee shall be required of each one attending the annual meeting to cover the expenses incurred in preparing for and conducting the ten days' clinical session. These are considerable and it is the policy of the Congress to make no financial demands, so far as that can be regulated, upon the profession of the city that has been so generous as to proffer the hospitality of its hospital wards, operating rooms and meeting places.

On the basis of the registered attendance at the meeting held in Chicago last year, it is estimated that a fee of $5.00 from each member registering will provide a sum sufficient to cover the expenses, and it has therefore been decided to make $5.00 the maximum fee. With each invitation has been sent an acceptance card. If the number of acceptances received indicates an attendance greatly in excess of the estimate, the registration fee will be reduced accordingly, as there is no intention to accumulate a surplus but simply to provide for the necessary expenses. It is also proposed to publish the transactions of the Congress in book form and to supply each member who attends with a copy of the same.

With the profession of the city in which the Congress meets furnishing a ten days' program of clinics, demonstrations, and scientific evening meetings, it is assumed that the visiting surgeons, who will have the privilege of participating in such priceless hospitality, will welcome the opportunity of meeting all the necessary expenses incurred in preparing for the meeting and in conducting the same, such as postage, printing, clercial work, rent of headquarters, and other management expenses.

REGISTRATION AND TICKETS

Each member upon registering at headquarters will receive a general ticket good for the ten days' session, admitting him to all clinics not bulletined as "special clinics" and to all the evening literary sessions. For clinics of special importance and those conducted where space is limited special tickets to the limit of the capacity of the special clinic will be distributed each day in order of application upon presentation by members of their general registration tickets.

DAILY BULLETIN OF CLINICS

Each afternoon there will be bulletined at headquarters the complete clinical program for the succeeding day and as soon thereafter as it can be issued a printed program will be distributed at headquarters, enabling each visitor to select his work a day in advance.

The bulletins and printed programs will designate the special features for which special tickets will be required.

HEADQUARTERS

A large room on the parlor floor of the Bellevue-Stratford will be used as headquarters, where at all times an adequate force of clerks will be maintained to attend to the registering of visiting surgeons and the issuing of special tickets for clinics. In connection therewith will be maintained an information bureau for the assistance of the visitors.

Every surgeon attending the Congress should register immediately on arrival and receive his general ticket of admission.

In order to do justice to those in attendance

and to facilitate caring for all without confusion, orderlies will demand the presentation of tickets at each hospital. This measure, for obvious reasons, must be faithfully adhered to by the attending physicians. As over eighteen hundred visitors can be comfortably accommodated in the various amphitheatres and clinic rooms within a short distance of headquarters, there need be no fear of overcrowding.

RAILROAD RATES AND TRAFFIC ARRANGEMENTS

On account of the Philadelphia meeting the railway companies have granted in certain territory a rate of one and three-fifths fares for the round trip, on the certificate plan, contingent upon a minimum of one hundred certificates being presented for validation from points where the full first-class one-way fare to Philadelphia is 75 cents or over. This reduced rate is granted by the railway lines comprising the Trunk Line Association, the Southeastern Passenger Association, and Eastern Canadian Passenger Association. The territory in which this rate is available in general includes: Pennsylvania, New York, New Jersey, Delaware, Maryland, West Virginia, Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, a part of Louisiana, including New Orleans; and all of Canada lying east of Port Arthur on Lake Superior.

Within the limits of this territory tickets will be sold and certificates issued on November 4th, 5th, 6th, and 7th, also on November 10th, 11th, 12th, and 13th. To secure the advantage of this rate, one must purchase a ticket to Philadelphia at the regular first-class fare, securing from the agent a certificate therefor at the time of purchase. *Do not ask for a receipt.* Further details may be had upon application to the local passenger officials.

Upon registration at headquarters this certificate must be deposited for the endorsement of the General Manager, Mr. A. D. Ballou, and for validation by a special agent of the Trunk Line Association, for which a fee of 25 cents must be paid at the time of depositing the certificate. It is important that the certificate be deposited immediately upon arrival in Philadelphia as the special agent of the railway companies will be present only on November 7th and 8th to visé certificates dated November 4th to 7th inclusive, and again on the 13th and 14th to visé certificates dated November 10th to 13th inclusive. This certificate when duly endorsed and validated entitles the holder to purchase a return ticket ever the same route as used in reaching Philadelphia at three-fifths of the regular one-way first-class fare, such tickets to be used not later than November 20th.

In those states not included in the above list no reduced rates have been granted for this meeting, but it has been suggested that in many cases it will be possible for members residing in outside territory to take advantage of the reduced fare arrangement by purchasing local tickets to some point where the reduced rates are available. Also at certain points in the Pacific Coast states and in the extreme Northwest, there will be in effect at that time a nine months' tourist rate under which a round trip ticket to Philadelphia can be purchased at a considerable reduction over the usual fare.

SPECIAL TRAIN AND CARS

The Pennsylvania Lines will make special arrangements to take care of the traffic originating in Chicago and that which naturally would come through this city from the West, and if the number of tickets sold warrants will provide a special train for this purpose. Such train, composed entirely of Pullman cars, with dining and library-buffet cars attached, will leave Chicago at 3 P. M. Sunday, November 5th, and arrive in Philadelphia Monday afternoon.

It has also been thought desirable to arrange for special cars from such cities as St. Louis, Cincinnati, Detroit, Cleveland, and Indianapolis over the Pennsylvania Lines, such cars to be attached to regular trains leaving Sunday afternoon or evening and arriving at Pittsburgh during the early morning hours on Monday, there to be consolidated with the cars from Chicago, thus providing a daylight ride through the state of Pennsylvania. Surgeons living in the above mentioned cities and adjacent territory who propose attending the Philadelphia meeting should apply for reservations at an early date so that the railway officials may properly take care of this special traffic.

The Baltimore and Ohio Railroad is also making preparations to take care of the traffic to Philadelphia and will arrange for special cars to be added to its regular trains leaving Chicago.

THE CLINICAL PROGRAM

A SCHEDULE OF EACH DAY'S CLINICAL FEATURES WILL BE BULLETINED AT HEADQUARTERS ON THE AFTERNOON OF THE PRECEDING DAY

HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA

C. H. FRAZIER	Clinical demonstrations. Laboratory demonstrations.
EDWARD MARTIN	Open treatment of fractures. Urinary calculi. Vasa-epididymostomy.
B. A. THOMAS	Results of cases treated, and a demonstration of dessication by the monopolar high frequency current of surface growths and hollow viscera neoplasmata, benign and malignant.
G. G. DAVIS	Treatment of tuberculous disease of hip and spine; congenital luxation of hip; paralysis from anterior poliomyelitis; operations for ankylosed and flail joints.
T. T. THOMAS	Shoulder injuries, two new operations.
JOHN B. DEAVER	Operations on the appendix, stomach and gall passages.
GEORGE FETTERHOLF	Clinical anatomy of thorax.
E. H. SITER	Genitourinary technique.
A. A. UHLE	Renal insufficiency.
W. H. MACKINNE	Urethroscope.
JOHN L. LAIRD	Cystoscope and catheterizing ureters.
ALFRED C. WOOD and E. E. ELIASON	Instruments: (*a*) Demonstration of a tourniquet for the control of hæmorrhage from the scalp during operations on the skull or brain. (*b*) Osteoplastic resection of the skull by means of an instrument operated by hand. Technique: A method of exposing the spinal laminæ.
J. B. CARNETT	Hernia: with operations, inguinal, femoral, and umbilical. Typhoid perforation and treatment.
C. C. NORRIS	Treatment of sterility and dysmenorrhœa by means of a new form of stem pessary. Review of all cases of latter condition. Gonorrhœa in women.
BARTON COOKE HIRST	Technique of hysterectomy for various indications; vaginal and abdominal hysterectomies; operative treatment of obstructed labors and placenta prævia; repair of the genital canal.
W. R. NICHOLSON	Methods of intrauterine bacteriological examination.
R. TAIT MCKENZIE	Treatment of flat foot, round shoulders, lateral curvature, or hernia, by exercise.
H. K. PANCOAST	Stereoscopic work.
GEORGE E. DE SCHWEINITZ and J. T. CARPENTER	Surgery of the eye.
T. B. HALLOWAY, CARL WILLIAMS and H. MAXWELL LANGDON	Demonstration of special methods of diagnosis.
J. E. SWEET and EDWARD MARTIN	Open treatment of fractures. Arterial suture. Vascular anastomosis.
GEORGE P. MULLER	Demonstration of patients operated upon for various joint lesions: tuberculous arthritis, ankylosis, rheumatoid arthritis, etc. Demonstration of certain malpositions and anomalies of the gastrointestinal tract with special reference to ptosis. Effect of salt solution, introduced intravenously, upon hæmolysis. Demonstrations in surgical pathology.
C. P. GRAYSON	Demonstration of correction of deflections of the nasal septum, with local, followed by general anæsthesia. Tonsillectomy versus tonsillotomy. The intranasal surgery of the accessary sinuses.
B. A. RANDALL and RALPH BUTLER	Radical tympanomastoid exenteration for middle ear caries. Surgical anatomy of the temporal bone. (Demonstration with specimens and lantern.) Diagnostic tests in otologic practice. The best every day treatment of chronic catarrhal and suppurative ear disease.
BROOKE M. ANSPACH	Perineal operations with adaptation of subcuticular suture.
FLOYD E. KEENE	Diagnosis of renal tuberculosis.
JOHN G. CLARK	Surgical phases of enteroptosis and other current clinical material.

PENNSYLVANIA HOSPITAL

W. E. Lee	Surgical technique of the hospital. Surgery of the peritoneum; acute, localized, and diffuse inflammations; tubercular peritonitis. Cystoscopic examinations. Fractures and dislocations. Nov. 7, 13, and 15, 10 A. M.; Nov. 13, 3 to 4 P. M.
Robert G. Le Conte	Tubercular glands of the neck; goiter. Surgery of the female perineum. Acute inflammations of bone. Nov. 7, 11 to 1; Nov. 11, 12 to 1; Nov. 16, 11:30 to 1.
Drs. Packard and Coates	Surgery of the ear, nose and throat. Nov. 7, 2 to 4.
Francis A. Packard	Surgical diseases of the ear. Nov. 15, 2 to 4.
W. T. Longcope	Surgical pathology. Nov. 8, 10 A. M.
John H. Gibbon	Hernia; inguinal, femoral, umbilical. Malignant diseases; tumors of the breast. Surgery of the kidney, ureter and bladder. Nov. 8, 11 to 1; Nov. 13, 11:30 to 1; Nov. 15, 11 to 1.
Drs. Schwenk and Shoemaker	Surgery of the eye. Nov. 8 and 13, 2 P. M.
Drs. Allen and Ashhurst	Fractures and dislocations. Nov. 9 and 10, 10 A. M.
Edward B. Hodge	Traumatic surgery of the lung. Club foot and tendon transplantation. Nov. 9, 11:30 to 1; Nov. 16, 10 to 11:30.
Francis T. Stewart	Surgery of the heart and pericardium; thoracic aneurysm. Surgery of blood-vessels. Nov. 9, 2 to 4; Nov. 14, 11:30 to 1.
Arthur E. Billings	Surgery of the female pelvis. Nov. 10, 11:30 to 1.
Drs. Eves and Scarlet	Surgery of the ear, nose and throat. Nov. 10, 2 to 4.
Charles F. Mitchell	Surgery of the intestine; typhoid perforations. Surgery of the upper abdomen. Nov. 11 and 14, 10 A. M.
Charles N. Davis	Surgical diseases of the skin. Nov. 14, 2 to 4.

JEFFERSON HOSPITAL

Orville Horwitz and Hiram R. Loux	Genitourinary clinic; alternate days; 1 to 2 P. M.
W. F. Hansel and William M. Sweet	Eye clinic; Nov. 8, 9, and 10; 2:30 to 4 P. M.
J. Chalmers DaCosta and Charles F. Nassau	Surgical clinic; Nov. 8, 10, 13, and 15; 1 P. M.
John H. Gibbon	Surgical clinic; Nov. 7, 11, and 14; 1 to 3 P. M.
H. Augustus Wilson	Orthopedic clinic; Nov. 7, 9, 11, 14, and 16; 10 to 11 A. M.
E. E. Montgomery and J. M. Fisher	Gynecological clinic; daily; 9 to 11 A. M.
S. McCuen Smith	Otological clinic; Nov. 8, 10, 13, and 15; 1 to 2 P. M.
Edward P. Davis	Obstetrical clinic; daily; 4 to 5 P. M.
D. Braden Kyle	Laryngological clinic; Nov. 7, 9, 11, 14, and 16; 1 P. M.
Willis F. Manges	X-ray clinic; daily; 1 to 2 P. M.

PRESBYTERIAN HOSPITAL

George Strawbridge	Surgery of the eye. Nov. 7, 2 to 4 P. M.
W. S. Newcomet	X-ray therapeutics. Nov. 7, 2 to 4 P. M.
John H. Girvin	Gynecological clinic. Nov. 8, 2 to 4 P. M.
H. R. Wharton	Surgical clinic. Nov. 9, 2 to 4 P. M.
George Erety Shoemaker	Gynecological clinic. Nov. 10, 2 to 4 P. M.
D. B. Pfeiffer	Surgical pathology. Nov. 10, 2 to 4 P. M.
E. B. Hodge	Surgical clinic. Nov. 11, 2 to 4 P. M.
John H. Jopson	Surgical clinic. Nov. 13, 2 to 4 P. M.
George C. Stout and A. H. Cleveland	Ear, nose and throat clinic (surgical). Nov. 14, 2 to 4 P. M.
Frank C. Knowles	Surgical diseases of the skin. Nov. 14, 2 to 4 P. M.
William D. Rodman	Surgical clinic. Nov. 15, 2 to 4 P. M.
Richard F. Woods	Gynecological clinic. Nov. 15, 2 to 4 P. M.

PHILADELPHIA LYING-IN CHARITY HOSPITAL

G. M. Boyd	Obstetrical clinic; Nov. 10, 12 to 1.
Stricker Coles	Obstetrical clinic; Nov. 14, 12 to 1.

PHILADELPHIA GENERAL HOSPITAL

WILMER KRUSEN	Obstetrical clinic; November 7, 11 to 1 P. M.
H. M. CHRISTIAN	Genitourinary clinic; Nov. 7, 2 to 4 P. M.
WALTER ROBERTS	Laryngological clinic; Nov. 7, 4 to 6 P. M.
H. A. WILSON	Orthopedic clinic; Nov. 8 and 10, 9 to 11 A. M.
JOSEPH W. HEARN	Surgical clinic; Nov. 8 and 15, 11 to 1 P. M.
E. H. SITER	Genitourinary clinic; Nov. 8, 2 to 4 P. M.
GEORGE E. DE SCHWEINITZ	Eye clinic; Nov. 8 and 15, 4 to 6 P. M.
J. B. CARNETT	Surgical clinic; Nov. 9, 9 to 11 A. M.
W. J. ROE	Oral surgery clinic; Nov. 9 and 16, 11 to 1 P. M.
M. B. HARTZELL	Dermatological clinic; Nov. 9, 2 to 4 P. M.
ERNEST LAPLACE	Surgical clinic; Nov. 9, 4 to 6 P. M.
GEORGE P. MULLER	Surgical clinic; Nov. 10, 9 to 11 A. M.
FRANK D. DICKSON	Orthopedic clinic; Nov. 10, 11 to 1 P. M.
E. P. DAVIS	Gynecological and Obstetrical clinic; Nov. 10, 2 to 4 P. M.
J. C. KNIPE	Eye clinic; Nov. 10, 4 to 6 P. M.
HENRY TUCKER	Genitourinary clinic; Nov. 11, 9 to 11 A. M.
L. W. STEINBACH	Surgical clinic; Nov. 11, 11 to 1 P. M.
M. P. WARMUTH	Surgical clinic; Nov. 11, 2 to 4 P. M.
W. M. SWEET	Eye clinic; Nov. 11, 4 to 6 P. M.
WILLIAM L. RODMAN	Surgical clinic; Nov. 13, 9 to 11 A. M.
M. H. CRYER	Oral surgery clinic; Nov. 13, 11 to 1 P. M.
M. B. MILLER	Surgical clinic; Nov. 13, 2 to 4 P. M.
B. M. ANSPACH	Gynecological clinic; Nov. 13, 4 to 6 P. M.
T. T. THOMAS	Surgical clinic; Nov. 14, 9 to 11 A. M.
ELLA B. EVERITT	Obstetrical clinic; Nov. 14, 11 to 1 P. M.
H. R. LOUX	Surgical clinic; Nov. 14, 2 to 4 P. M.
ALEXANDER UHLE	Genitourinary clinic; Nov. 14, 4 to 6 P. M.
GEORGE M. BOYD	Obstetrical clinic; Nov. 15, 9 to 11 A. M.
R. C. NORRIS	Obstetrical clinic; Nov. 15, 2 to 4 P. M.
H. K. GASKILL	Dermatological clinic; Nov. 16, 2 to 4 P. M.
HERSHEY THOMAS	Surgical clinic; Nov. 16, 4 to 6 P. M.

SAMARITAN HOSPITAL

WILMER KRUSEN	Gynecological clinic. Nov. 8, 11, and 15; 12 M.
GUTHRIE MCCONNELL	Demonstration of the surgical pathology of malignant tumors. Nov. 8, 2 P. M.
COLLIER MARTIN	Rectal clinic. Demonstration of results obtained in the treatment of fistula in ano. Nov. 8 and 15, 3 P. M.
W. WAYNE BABCOCK	Surgical clinic with demonstration of segment anæsthesia by intradural injection. Demonstration of plastic or reconstructive surgery. Nov. 8 and 15, 4 P. M.; Nov. 11, 3 P. M.
HARRY G. DUNCAN	Demonstration of cystoscopy and ureteral catheterization. Nov. 9, 1 P. M.
NATHAN G. WARD	Use of high frequency currents and static wave current in the treatment of diseases of nose and throat. Nov. 9, 2 P. M.
HARRY HUDSON	Orthopedic clinic. Nov. 9, 4 P. M.
WILLIAM H. HITSCHLER	Ear, nose and throat clinic. Demonstration of excision of the facial and pharyngeal tonsils. Nov. 10, 3 to 4; Nov. 13, 2:30 P. M.
WILLIAM E. ROBERTSON	Surgical errors in the diagnosis of intra-abdominal disease. Nov. 10, 4 P. M.
A. PARKER HITCHENS	Preparation of bacterial vaccines. Application of bacterial vaccines and allied products in surgical therapeutics. Nov. 10, 5 P. M.; Nov. 15, 2 P. M.
C. E. DE M. SAJOUS	The rôle of the ductless glands in relation to surgical therapeutics. Nov. 11, 2 P. M.
WILLIAM A. STEEL	Genitourinary clinic. Nov. 13, 4 P. M.
J. F. SCHAMBERG	Stereopticon demonstration of syphilis with special reference to the newer therapy. Nov. 13, 5 P. M.
WENDEL REBER	Ophthalmic operative clinic. Nov. 14, 3 P. M.

POLYCLINIC HOSPITAL

B. F. Baer	Gynecological clinic. Nov. 7 and 14, 2 P. M.
L. H. Adler	Rectal clinic. Nov. 7, 1 P. M.; 13, 2 P. M.
J. M. Baldy	Pelvic inflammatory disease. Uterine displacements and fibroid tumors. Nov. 9 and 16, 10 A. M.
John B. Roberts	Surgical clinic. Demonstration of plastic operations on cadaver (laboratory). Plastic surgery of the face, exhibiting operations and results. Nov. 9 and 16, 11 A. M.
J. B. Roberts and L. W. Steinbach	Surgical clinic. Nov. 11, 11 A. M.
F. R. Packard	Nose and throat clinic. Operations on the accessary sinuses. Demonstration in tracheobronchoscopy. Nov. 8 and 15, 3 P. M.
G. M. Dorrance and N. Ginsberg	Demonstration of transfusion methods (laboratory). Nov. 10, 10 A. M.
G. M. Dorrance	Demonstrations in operative gynecology (laboratory). Nov. 10, 3 P. M.; Nov. 16, 1 P. M.
R. Butler	Demonstration in operative surgery of the ear and mastoid (laboratory). Nov. 8 and 15, 4 P. M.
W. Reber	Ophthalmological clinic. Nov. 8, 1 P. M.
E. L. Vansant	Nose and throat clinic. Submucous operations for deviation of the nasal septum. Nov. 8 and 15, 12 M.
J. A. Kelly	Demonstration in surgical pathology. Nov. 9, 1 P. M.; Nov. 13, 12 M.
J. F. Schamberg	Dermatological clinic. Exhibition of cases of lupus and skin cancer treated by X-ray and other methods. Treatment of angiomata and other nævi by solid carbon dioxide. Nov. 7 and 11, 12 M.
A. Hewson	Demonstration in regional and surgical anatomy. Nov. 7, 3 P. M.; Nov. 14, 12 M.
L. W. Steinbach	Surgical clinic. Surgery of the thyroid gland. Nov. 7 and 14, 11 A. M.
J. H. Jopson and J. Speese	Surgical clinic. Treatment of pulmonary tuberculosis by nitrogen injections. Nov. 8, 11 A. M.
J. H. Jopson	Surgical clinic. Nov. 15, 11 A. M.
C. L. Leonard	Demonstration in X-ray laboratory. Rapid stereoroentgenology. Nov. 7, 4 P. M.; Nov. 11, 1 P. M.; Nov. 14, 3 P. M.
A. A. Sargent	Demonstration in refraction. Nov. 7 and 14, 10 A. M.
W. Roberts	Aural clinic. Nov. 8 and 15, 2 P. M.; Nov. 13, 1 P. M.
William R. Nicholson	Gynecological clinic. Cystoscopy and ureteral catheterization. Nov. 8, 11, and 15, 10 A. M.
M. B. Miller	Surgical clinic. Hernia. Demonstration in operative surgery. Methods of intestinal anastomosis (laboratory). Nov. 10 and 13, 11 A. M.
J. K. Young	Orthopedic clinic. Diagnosis and treatment of infectious arthritis. Tendon transplantation for infantile paralysis; Lange's operation. Nov. 9 and 16, 2 P. M.
A. W. Watson	Nose and throat clinic. Nov. 9 and 16, 3 P. M.
W. M. Sweet	Ophthalmological clinic. Ocular injuries by foreign bodies. Nov. 10, 1 P. M.
W. M. Sweet and C. R. Heed	Demonstration in operative ophthalmology (laboratory). Nov. 11 and 15, 1 and 4 P. M.
J. P. Tunis	Demonstration in operative surgery of throat and nose (laboratory). Nov. 11, 3 P. M.; Nov. 16, 4 P. M.
B. A. Thomas	Genitourinary clinic. Chromoureteroscopy, demonstrating carmine test. Intravenous use of salvarsan. Functional kidney diagnosis by the Duboscq colorimeter. The Wasserman technique. Nov. 10 and 14, 4 P. M.
W. C. Posey	Ophthalmological clinic. Nov. 9, 4 P. M.
M. B. Miller, R. M. Goepp and J. A. Kelly	Arteritis obliterans. Exhibition of patients and specimens. Nov. 10, 12 M.
J. Thorington	Refraction. Nov. 10, 2 P. M.
G. M. Coates	Aural clinic. Nov. 11, 2 P. M.
J. S. Gibb	Nose and throat clinic. Tonsillectomy by modern methods. Nov. 13, 3 P. M.
G. H. Makuen	Faulty operations on the tonsils, and their effect on the soft palate and the voice. Nov. 13, 4 P. M.
T. Erck	Gynecological clinic. Nov. 14, 1 P. M.

WOMAN'S HOSPITAL OF PHILADELPHIA

SARAH H. LOCKREY	Gynecological clinic; Nov. 7 and 16, 10 A. M.
EMMA E. MUSSON	Yankauer's Eustachian tube work; Nov. 7, 2 P. M. Bronchoscopic and esophageal tube work; Nov. 14, 2 P. M.
CAROLINE M. PURNELL	Gynecological clinic; Nov. 8 and 15, 10 A. M.
MIRIAM BUTT	Eye clinic; Nov. 8 and 15, 2 P. M.
KATE W. BALDWIN	Surgical clinic; Nov. 9, 10 A. M. Beeswax in bone cavities and in cavities of the soft tissues; Nov. 11, 2 P. M.
MARY W. GRISCOM	Obstetrical clinic; Nov. 9, 1 P. M.
MARIE K. FORMAD	Panhysterectomy; Nov. 10, 10 A. M. Gynecological clinic; Nov. 14, 10 A. M.
MARGARET F. BUTLER	Submucous resection; Nov. 10, 2 P. M. Removal of tonsils and adenoids; Nov. 13, 2 P. M.
CATHARINE MACFARLANE	Cystoscopy and Bier's hyperemia; Nov. 11, 10 A. M.
FRANCES R. SPRAGUE	Surgical clinic; Nov. 13, 10 A. M.
MARY GETTY	Eye clinic; Nov. 16, 2 P. M.

HOSPITAL OF THE WOMAN'S MEDICAL COLLEGE

ELLA B. EVERITT	Gynecological clinic. Nov. 7, 9, 14, and 16, 1 P. M.
MARGARET F. BUTLER	Laryngological and rhinological clinic. Nov. 8 and 15, 2 P. M.
HARRY C. DEAVER	Surgical clinic. Nov. 10, 1 P. M.
EMMA E. MUSSON	Aural clinic. Nov. 13, 2 P. M.

KENSINGTON HOSPITAL

H. C. DEAVER	Gynecological clinic; November 9 and 13, 2 to 5 P. M.

CHILDREN'S HOSPITAL

H. R. WHARTON	Surgical clinic. Nov. 7.
F. R. PACKARD	Nose and throat clinic. Nov. 8.
B. A. RANDALL	Ear clinic. Nov. 9.
J. H. JOPSON	Surgical clinic. Nov. 10.
W. C. POSEY	Eye clinic. Nov. 11.
E. B. HODGE	Surgical clinic. Nov. 13.
F. K. KNOWLES	Surgical skin affections. Nov. 14.
C. Y. WHITE	Surgical pathology. Nov. 16.

STETSON HOSPITAL

LEWIS S. SOMERS	Ear, nose and throat clinic; Nov. 8 and 13; 12 to 1.
ISAAC LEOPOLD	Eye clinic; Nov. 10 and 14; 12 to 1.
STEPHEN E. TRACY	Catheterization of ureters; Nov. 8, 12:30 to 1:30. Gynecological clinic (days to be announced later).
JOHN A. BOGER	Surgical clinic; Nov. 13 and 15; 1.
B. M. ANSPACH	Gynecological clinic; Nov. 7, 9, 11, 14; 12 to 1.
W. B. ODENATT	Case of enlarged thymus in child of four months; case of situs viscerum inversus; intragastric faradism in gastric atony; Nov. 8 and 11; 12 to 1.
CARLE LEE FELT	Ear, nose and throat clinic; Nov. 9 and 14; 12 to 1.
GEORGE G. ROSS	Surgical clinic; Nov. 7, 9, 11, and 14; 12 to 1.

CHILDREN'S HOMEOPATHIC HOSPITAL

H. S. WEAVER, F. W. SMITH and OSCAR SEELEY	Ear, nose and throat clinics; Nov. 9 and 16, 2:30 to 5.
L. W. THOMPSON	Surgical clinic; Nov. 9 and 16, 2:30 to 5.

ST. LUKE'S HOMEOPATHIC HOSPITAL

D. ROMAN	Goiter. Nov. 11 and 14, 2:30 to 5.

MEDICO-CHIRURGICAL HOSPITAL

ERNEST LAPLACE	Surgical clinic; Nov. 7 and 11; 11 to 1 P. M.; Nov. 13 and 15; 9 to 11 A. M.
H. M. CHRISTIAN	Genitourinary clinic; Nov. 8 and 15; 11 A. M. to 1 P. M.
W. L. RODMAN	Surgical clinic; Nov. 8, 10, 14, and 16; 9 to 11 A. M.
J. P. MANN	Orthopedic clinic; Nov. 9 and 14; 11 to 12 A. M.
W. E. ASHTON	Gynecological clinic; Nov. 9 and 14; 12:30 to 2 P. M.
L. W. FOX	Eye clinic; Nov. 10 and 13; 1 to 3 P. M.
E. B. GLEASON	Otological clinic; Nov. 10 and 15; 3 to 4 P. M.
S. C. BURNS	Oral surgical clinic; Nov. 11; 9 to 10 A. M.
G. M. BOYD	Obstetrical clinic; Nov. 13; 12 to 1 P. M.
A. H. CLEVELAND	Nose and throat clinic; Nov. 16, 12 to 2 P. M.

METHODIST EPISCOPAL HOSPITAL

J. B. ROBERTS	Surgical clinic. Nov. 7, 12 to 2; Nov. 14, 11 to 2.
JOSEPH SPELLISY	Surgical clinic. Nov. 9 and 16, 11 to 12 A. M.
J. T. RUGH	Orthopedic clinic. Nov. 8, 10, and 13, 11 to 12 A. M.
WALTER ROBERTS	Otological and laryngological clinic. Nov. 9 to 16, 1 to 4 P. M.
L. T. HAMMOND	Surgical clinic. Nov. 8, 10, and 13, 12 to 2 P. M.
J. P. MOORE	Ophthalmological clinic. Nov. 9 and 16, 4 P. M.
R. C. NORRIS	Gynecological clinic. Nov. 14, 2 P. M.
L. A. SALADE	Gynecological clinic. Nov. 13, 2 P. M.

ST. JOSEPH'S HOSPITAL

J. M. SPELLISY	Surgical clinic, Nov. 7, 9, and 14; 1 P. M.
M. M. FRANKLIN	Surgical clinic, Nov. 7, 9, and 14; 9 A. M.
C. F. NASSAU	Surgical clinic, Nov. 7, 9, and 14; 3 P. M.
E. E. MONTGOMERY	Gynecological clinic, Nov. 7, 10, and 14, 11 A. M.
P. B. BLAND and F. H. MAIER	Gynecological clinic, Nov. 8, 9, 11, 13, 15, and 16; 11 A. M.
S. L. ZIEGLER and P. J. PONTIUS	Ophthalmological clinic, Nov. 8, 10, and 15, 4 P. M.
DR. JONES	Ophthalmological clinic, Nov. 9, 11, 14, and 16, 4 P. M.
G. M. MARSHALL	Ear, nose and throat clinic, Nov. 7, 8, 11, 14, and 15. 9 A. M.
DR. SENDERS	X-ray clinic. Daily at noon.

HOWARD HOSPITAL

BARTON COOKE HIRST	Gynecological clinic; Nov. 7 and 14.
ALFRED C. WOOD	Surgical clinic; Nov. 10, 12:30 P. M.
W. C. POSEY	Ophthalmological operations; Nov. 13, 2 P. M.
GEORGE B. WOOD	Tonsillectomy; accessory sinus disease; straightening of crooked nasal septum; mastoid operation, etc.; Nov. 9 and 16, 2 P. M.

WILLS EYE HOSPITAL

P. J. PONTIUS, M. RADCLIFFE, S. L. ZIEGLER, C. BERENS, S. D. RISLEY, F. FISHER, W. C. POSEY, P. N. K. SCHWENK and W. ZENTMAYER	Operative clinics daily; 2 to 3 P. M.

JEWISH HOSPITAL

W. H. TELLER, E. L. KLOPP, L. W. STEINBACH and DR. STERN	Surgical clinics.
E. L. KLOPP and S. M. SMITH	Otological clinics.
A. W. WATSON	Laryngological clinics.
W. G. ELMER	Orthopedic clinics.
ISAAC LEOPOLD and J. C. KNIPE	Ophthalmological clinics.

ORTHOPEDIC HOSPITAL

WILLIAM J. TAYLOR	Cases of operation for brain tumors; cerebellar cyst. Discussion of laminectomy for Pott's disease; operation for exophthalmic goiter.
GWILYM G. DAVIS	Tendon transplantation; cases of arthroplasty, arthrodosis; cases illustrative of treatment of club foot, tuberculous disease of joints, etc.

GERMAN HOSPITAL

JOHN B. DEAVER	Surgical clinic every other day.

GYNECEAN HOSPITAL

J. M. BALDY	Supravaginal hysterectomy with anchorage of the cervix to the round ligaments in connection with plastic operations for uterine prolapse. Suspension of the uterus by posterior attachment of the round ligaments. Hysterectomy for carcinoma of the cervix. Hysterectomy for fibroid tumor of the uterus. Nov. 8 and 13, 10 A. M.
HENRY D. BEYEA	Suspension of the stomach for gastroptosis by plication of the gastrohepatic omentum. Supravaginal resection of the uterus for fibroid tumor, with conservation of a part of the endometrial cavity and the ovaries. Nov. 9, 10 A. M.
THEODORE ERCK	Suspension of the kidney. Hysterectomy for pelvic inflammatory disease. Nov. 10, 10 A. M.
BROOKE M. ANSPACH . . .	Cystoscopic examination and catheterization of the ureters. Vesicovaginal interplacement of the uterus for cystocele and prolapse. Resection of excessive fat from the abdominal wall in connection with operation for ventral hernia. Nov. 11, 10 A. M.
GEORGE W. OUTERBRIDGE .	Demonstration of interesting gynecological specimens. Nov. 14, 10 A. M. Demonstration of specimens removed at each operation and other specimens bearing on cases of the day, daily.

EPISCOPAL HOSPITAL

H. C. DEAVER	Surgery of the female pelvis. Nov. 7, 2 to 4 P. M.
LOUIS MUTSCHLER	Surgery of hernia. Nov. 8, 2 to 4 P. M.
T. R. NEILSON	Surgery of the urinary tract. Nov. 9, 2 to 4 P. M.
G. ORAM RING	Surgical diseases of the eye. Nov. 10, 2 to 4 P. M.
CHARLES H. FRAZIER . . .	Surgery of the stomach and duodenum. Nov. 11, 2 to 4 P. M.
C. Y. WHITE	Vaccine therapy. Nov. 13, 2 to 4 P. M.
C. C. BIEDERT	Surgical diseases of the ear, nose and throat. Nov. 14, 2 to 4 P. M.
A. P. C. ASHHURST . . .	End results of fracture of the femur. Nov. 15, 2 to 4 P. M.
J. L. BROMLEY	Surgical diseases of the eye. Nov. 16, 2 to 4 P. M.

HAHNEMANN HOSPITAL

Surgical Clinics — Nov. 8 and 15, 2:30 to 5.

W. B. VAN LENNEP . . .	Prostatectomy; hernia.
H. L. NORTHROP	Goiter; appendix.
G. A. VAN LENNEP . . .	Stomach and gall-bladder.
H. P. LEOPOLD	Open treatment of fractures.
W. N. HAMMOND	Club foot; tendon transplanation.
J. D. ELLIOTT	Breast tumors.
C. A. BIGLER, JR.	Hæmorrhoids; fistula; other current clinical material.

Gynecological and Obstetrical Clinics—Nov. 11, 2.30 to 5; Nov. 16, 10:30 to 1.

D. B. JAMES	Pelvic inflammatory disease; fibroids.
N. F. LANE	Uterine displacements.
J. E. JAMES, JR.	Obstetrical demonstration; repair of genital canal.

Eye, Ear, Nose and Throat Clinics—Nov. 8, 11, and 15, 2:30 to 5.

W. W. SPEAKMAN	Operations on the eye.
F. W. SMITH and OSCAR SEELEY	Demonstration of tracheo-bronchoscopy and œsophagoscopy.
I. G. SHALLCROSS and H. S. WEAVER	Surgery of the accessory sinuses; nose and throat clinic.
G. J. PALEN	Radical mastoid operation.

EVENING LITERARY SESSIONS

Wednesday, November 8th

PHILADELPHIA COUNTY MEDICAL SOCIETY — In Mitchell Hall, College of Physicians, at 8:15 P. M.

SURGERY OF THE UPPER ABDOMEN

1. Surgical Pathology of the Stomach and Duodenum J. F. BINNIE, M. D., Kansas City, Missouri.
   Discussion opened by W. L. RODMAN, M. D., Philadelphia.
2. Surgery of the Liver and Bile Ducts . . . GEORGE EMERSON BREWER, M. D., New York City.
   Discussion opened by ROBERT G. LECONTE, M. D., Philadelphia.
3. Surgery of the Pancreas . . . . . MAURICE H. RICHARDSON, M. D., Boston.
   Discussion opened by JOHN B. DEAVER, M. D., Philadelphia.

Thursday, November 9th

PRESIDENTIAL MEETING — In the Ball Room of the Bellevue-Stratford, at 8:15 P. M.

President's Address: Co-ordination of Undergraduate and Postgraduate Teaching of Clinical Surgery . . . . . ALBERT J. OCHSNER, M. D., Chicago.

The Technique and Remote Results of Blood-vessel Anastomoses (Lantern Demonstration) . . . . . ALEXIS CARREL, M. D., New York City.

Cancer of the Stomach; Its Surgical Cure (Lantern Demonstration) . . . . . WILLIAM J. MAYO, M. D., Rochester, Minn.

Friday, November 10th

PHILADELPHIA NEUROLOGICAL SOCIETY — In Mitchell Hall, College of Physicians, at 8:15 P. M.

The Technique and Results of Deep Injections of Alcohol for Ticdouloureux . . . . . HUGH T. PATRICK, M. D., Chicago.
Discussion to be opened by F. X. DERCUM, M. D., Philadelphia.

Surgery of the Pituitary Body . . . . . HARVEY CUSHING, M. D., Baltimore.

Operative Treatment of Experimental Lesion of the Spinal Cord Equivalent to the Crush Injury of Fracture Dislocation of the Spinal Column . . ALFRED REGINALD ALLEN, M. D., Philadelphia.
Discussion to be opened by CHARLES H. FRAZIER, M. D., Philadelphia.

Monday, November 13th

PHILADELPHIA ACADEMY OF SURGERY — In Mitchell Hall, College of Physicians, at 8:15 P. M.

Some Observations on the Thyroid Gland and Its Diseases, CHARLES H. MAYO, M. D., Rochester, Minn.
Discussion to be opened by FRANCIS J. SHEPHERD, M. D., Montreal, Quebec.

The Operative Treatment of Fractures . . . . . JOSEPH A. BLAKE, M. D., New York City.
Discussion to be opened by EDWARD MARTIN, M. D., Philadelphia.

The Significance of Blood in the Stools . . . . . J. M. T. FINNEY, M. D., Baltimore.
Discussion to be opened by MAURICE H. RICHARDSON, M. D., Boston, Mass.

Tuesday, November 14th

PEDIATRIC SOCIETY OF PHILADELPHIA — In Mitchell Hall, College of Physicians, at 8:15 P. M.

THE SURGERY OF CHILDHOOD

1. Pyloric Stenosis in Infancy, Its Surgical Treatment (Lantern Demonstration) . . . . . CHARLES L. SCUDDER, M. D., Boston.
2. Some Differences between the Surgery of Children and Adults (Lantern Demonstration) . . . . . CHARLES N. DOWD, M. D., New York City.
3. A Paper on Orthopedic Surgery . . . . . R. TUNSTALL TAYLOR, M. D., Baltimore.

Wednesday, November 15th

OBSTETRICAL SOCIETY OF PHILADELPHIA — In Mitchell Hall, College of Physicians, at 8:15 P. M.

Surgery of the Tubes and Ovaries . . . . . EDWARD REYNOLDS, M. D., Boston.
The Treatment of Ectopic Gestation . . . . . EDWARD B. CRAGIN, M. D., New York City.
The Circulation of Fibroid Tumors (Lantern Demonstration) JOHN A. SAMPSON, M. D., Albany, N. Y.

COMBINED MEETING OF THE SECTIONS ON OTOLOGY, LARYNGOLOGY AND OPHTHALMOLOGY
In Thompson Hall, College of Physicians, at 8:15 P. M.

The Surgery of the Sinuses and Its Relation to Orbital Complications . . . . . JOSEPH H. BRYAN, M. D., Washington, D. C.
The Relation between Otitic and Intracranial Diseases . . GORHAM BACON, M. D., New York City.
The Newer Operations for Glaucoma . . . . . JOHN E. WEEKS, M. D., New York City.

PHILADELPHIA HOTELS AND THEIR RATES PER DAY

HOTELS A, American; E, European.		One Person		Two Persons	
		Without Bath	With Bath	Without Bath	With Bath
BELLEVUE-STRATFORD, Broad and Walnut Sts	E	$2.50 up	$3.50 up	$3.50 up	$ 4.50 up
RITTENHOUSE, 22d and Chestnut Sts	E	1.50 "	2.00 "	2.50 "	3.00 "
	A	4.00 "	4.50 "	7.50 "	8.00 "
ST. JAMES, 13th and Walnut Sts	E	2.00 "	2.50 "	3.00 "	3.50 "
WALTON, Broad and Locust Sts	E	2.00 "	3.00 "	3.00 "	4.00 "
ALDINE, 1914 Chestnut St	E	2.50-5.00	3.00-5.00	3.50- 6.00	4.00- 6.00
	A	4.00-6.00	5.00-6.00	8.00-10.00	10.00-12.00
CONTINENTAL, 9th and Chestnut Sts	E	1.50 up	2.00 up	2.50 up	3.00 up
NEW BINGHAM, 11th and Market Sts	E	1.50 "	2.50 "	3.00 "	4.00 "
COLONNADE, 15th and Chestnut Sts	E	1.50 "	2.00 "	2.50 "	4.00 "
LORRAINE, Broad St. and Fairmount Ave	E	1.25 "	1.50 "	2.50 "	3.00 "
	A	3.50 "	.....	.....	.....
RODMAN, 800 North Broad St	E	.....	1.50 "	.....	3.00 "
NORMANDIE, Chestnut and 36th Sts	A	3.50 "	4.00 "	6.50 "	7.50 "
GREEN'S, 8th and Chestnut Sts	E	1.00-1.50	2.00 "	1.50-2.00	3.00 "
STENTON, Broad and Spruce Sts	E	1.50 up	2.50 "	2.50 up	4.00 "
MAJESTIC, Broad St., above Girard	E	2.00 "	2.50 "	3.00 "	4.00 "
HANOVER, 12th and Arch Sts	E	1.00 "	1.50 "	2.00 "	2.50 "

ALBERT J. OCHSNER

President of the Clinical Congress of Surgeons of North America

JOHN G. CLARK

Vice-President of the Clinical Congress of Surgeons of North America and Chairman of the Philadelphia Committee on Arrangements